ECOLOGICALLY SIGNIFICANT AREAS IN CAROLINE COUNTY

RARE PLANT SITES NEWLY IDENTIFIED OR UPDATED IN 2000

SUBMITTED TO:

Coastal Zone Management Division
Maryland Department of Natural Resources

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Wildlife and Heritage Division Statement on Data Dissemination

The Wildlife and Heritage Division considers nearly 1200 native plants and animals to be in need of protection or monitoring. Although habitat loss due to conversion and fragmentation is widely considered the greatest threat to the survival of Maryland's rare flora and fauna, some species are also vulnerable to and greatly threatened by illegal collection, over-exploitation, and excessive disturbance of their fragile habitats. Some examples of these threats include the black market pet trade, illegal butterfly collecting, purposeful destruction of rattlesnake dens, excessive disturbance in bat caves, illegal collection of orchids and other showy wildflowers, and illegal harvesting of plants considered useful as medicinals.

However, only a small fraction of these 1200 species, around 10%, are known or likely to be vulnerable to illegal collection or similar threats. Therefore, it is the current position of the Division to provide to county planning and zoning agencies and other conservation partners the names of species which occur at specific sites, except when the species is considered by Division ecologists to be "vulnerable", as described previously. These species will generally be omitted from the Protection Area Summaries. In cases where this type of species is the only one occurring at the site, the words "vulnerable species" will be used instead of the species' name.

We believe that the potential benefits in accomplishing significant conservation efforts with partners outweigh the potential loss of populations or habitats as a result of releasing locations of rare species sites. However, in order to reduce this risk, it is our intent that site locations and rare species names be used in-house by county planning and zoning agencies and other conservation partners for such activities as the review of development projects, land use planning, or site-specific conservation efforts by local land trusts. This information should not be released to the general public in order to protect the privacy of landowners and to avoid jeopardizing the species and their habitats. If organizations include these sites as a data layer within their geographic information systems, we request that rare species names not be attributed to the polygons for these sites. We look forward to working with partners to protect the rare species' habitats discussed in this report, and hope that partners will contact us if conservation opportunities or conflicts arise.

INTRODUCTION

The Wildlife and Heritage Division initiated field surveys in 2000 in order to improve knowledge of the occurrence and distribution of rare species' habitats and high quality natural communities within Caroline County. The information gathered from the 2000 surveys is being incorporated into the Programs' recommendations of sensitive areas for protection under the Economic Growth, Resource Protection and Planning Act of 1992. Protection and management recommendations will also be made to the Caroline County Office of Planning and Zoning. Data collected from the field surveys will be utilized to develop recommendations to Program Open Space for land acquisition with the Heritage Conservation Fund, to The Nature Conservancy for landowner contact and land acquisition, and to the Maryland Environmental Trust for protection through conservation easements.

METHODS

This survey concentrated on locating globally rare and state threatened and endangered plant species within Caroline County. The primary objective was to relocate recent records (1980-1995) of ten globally rare species and thirty-two state threatened and endangered species to update information on the populations of these species and their respective habitats. The second objective was to relocate old occurrences of rare species (pre-1980). The third goal was to locate previously unknown occurrences of rare species and significant natural communities in Caroline County.

The Wildlife and Heritage Division database was reviewed for all recent and historical records of rare, threatened, and endangered species' occurrences in Caroline County. Information was gathered concerning the habitat preference and flowering and fruiting period of each of these species. U.S. Geological Survey topographical maps (Quads), National Wetland Inventory maps, Caroline County geologic maps, soil maps, and aerial photographs were analyzed to determine the types of habitats known to support rare species in Caroline County. Based on these studies, five types of habitat were selected as the focus of field surveys: **Delmarva Bays or Seasonal Ponds**, **Mixed Deciduous Forests**, **Tidal Freshwater Marshes and Swamp Forests**, **Sand Ridges**, and **Coastal Plain Bogs**.

Much emphasis was placed on locating high quality **Delmarva Bays or Seasonal Ponds** in Caroline County. These circular, depressional wetlands are restricted to a five-county region on the Delmarva Peninsula with analogous wetland types occurring along the Atlantic Coastal Plain from New Jersey to Florida. Delmarva Bays often range from one to fifteen acres in surface area and can retain up to four feet of water in the spring. The vegetation community in these seasonal ponds often occurs as concentric rings and may vary annually due to hydrologic conditions. Vegetation zonation in Delmarva Bays is generally distinct with an outer perimeter of trees and shrubs, and an inner herbaceous plant community. This herbaceous plant community often contains rare, disjunct, or endemic species limited only to Delmarva Bays. The Delmarva Bays of Caroline County are known to support several globally rare plant species, which include Harper's

fimbristylis *(Fimbristylis perpusilla)*, Creeping St. John's-wort *(Hypericum adpressum)*, Rose coreopsis *(Coreopsis rosea)*, and Torrey's dropseed *(Muhlenbergia torreyana)*. Among the state endangered species reported from Delmarva Bays are Featherfoil *(Hottonia inflata)*, Aster-like boltonia *(Boltonia asteroides)*, and Walter's paspalum *(Paspalum dissectum)*. Many Delmarva Bays in Maryland have been destroyed as a result of agricultural conversion and logging.

Also selected for inventory in Caroline County were large contiguous tracts of **Mixed Deciduous Forests** containing steep ravines, seepage toeslopes, "rich woods" pockets, and forested slopes and floodplains. Particular attention was given to mixed deciduous forest communities in Caroline County along Marshyhope Creek, Mill Creek, Skeleton Creek, Tuckahoe Creek, and upper sections of the Choptank River. Forested slopes and ravines along Skeleton Creek and Mill Creek were known to support occurrences of the state threatened Single-headed pussytoes *(Antennaria solitaria)*. In addition, many of those sites are known to contain pockets of "rich woods" habitat which is unusual on the Coastal Plain. The cause of this anomaly is unknown, but the combination of well-drained soils and high pH has resulted in a mixed deciduous forest community with piedmont affinities. Often these areas will support wildflowers, ferns, and trees that are very rare on the Coastal Plain. These species are generally found in high nutrient soils of undisturbed forests over bedrock, such as in the piedmont region of Central Maryland. High quality floodplain forests bordering the Marshyhope Creek and Tuckahoe Creek were also targeted for survey. Rich alluvial soils and flooding dynamics have created a highly diverse natural community capable of supporting numerous rare plant species. Known from these systems are occurrences for the state endangered Upright burhead *(Echinodorus cordifolius)*, the state threatened Deciduous holly *(Ilex decidua)*, and the highly state rare Rough hedge-nettle *(Stachys aspera)*.

The **Tidal Freshwater Marshes and Swamp Forests** that border the Choptank River and Tuckahoe Creek in Caroline County represent the third major type of habitat selected for inventory. This type of habitat is maintained by the frequency and duration of flooding in addition to periodic saltwater intrusion. The ecological significance of tidal freshwater marshes and swamp forests cannot be understated. Reportedly having a more diverse assemblage of plants from the brackish and oligohaline (slightly brackish) estuarine marshes downstream, these systems are a vital component of biological diversity. Tidal freshwater marshes and swamp forests along the Choptank River and Tuckahoe Creek are known to support the state endangered Slender blueflag *(Iris prismatica)*, state threatened Parker's pipewort *(Eriocaulon parkeri)*, state threatened Lake-bank sedge *(Carex lacustris)*, and the state rare Salt-marsh bulrush *(Scirpus cylindricus)*. Many new sites were chosen to search for these and other rare species.

Sand Ridges bordering the Choptank River, Tuckahoe Creek, and Marshyhope Creek were chosen for inventory. Dry, sandy openings along these ridge crests are known to support several rare or uncommon plant species. Fire is one of the natural processes in which creates open habitats. Current fire suppression practices have prohibited the creation of canopy openings that result from natural fires. Therefore, the plants that require the full sun of these naturally open habitats are becoming rare. The sand ridges

paralleling the Choptank River, Tuckahoe Creek, and Marshyhope Creek are comprised of sandy soils that are typically nutrient-poor and have a low water retention capacity, thus providing harsh growing conditions for many plants. Those specially adapted to these conditions include many leguminous species that fix nitrogen and are capable of surviving in nutrient-poor soils. In most cases, these plants are specially adapted to survive in such harsh conditions by having nitrogen-fixing bacteria living in nodules on the roots. Species known from and targeted in this type of habitat include the globally rare, state endangered Cream-flowered tick-trefoil *(Desmodium ochroleucum)*, the state threatened Wild lupine *(Lupinus perennis)*, and the state rare Spurred butter-pea *(Centrosema virginianum)*.

A unique and uncommon natural plant community on the Coastal Plain of Maryland is that of **Coastal Plain Bogs**. Most bogs on the Coastal Plain are in powerline right-of-ways. Powerline maintenance activities such as mowing, minimizes woody plant succession in these areas and allows for an open canopy. Historically, fire and beaver activity were largely responsible for the creation and maintenance of these habitats. Current fire suppression practices and a decline in beaver populations on the Coastal Plain have eliminated this process. A large component of many Coastal Plain bogs are Sphagnum moss *(Sphagnum* sp.) and many specialized plant species that have adapted to the highly acidic environment. In addition, this highly diverse habitat often supports several types of carnivorous plant species that are rare in Maryland. Carnivorous plant species known from Maryland include Bladderworts *(Utricularia* spp.*)*, Sundews *(Drosera* spp.*)*, and even Northern pitcher-plants *(Sarracenia purpurea)*. Bogs in the Coastal Plain are also known to support many orchids in which often exhibit an incredible floral display during the growing season. Orchid species targeted for this survey include Rose pogonia *(Pogonia ophioglossoides)*, a watch list species, and the state threatened White fringed orchid *(Platanthera blephariglottis)* and Crested yellow orchid *(P. cristata)*.

After reviewing the database, the species and habitat information, and the various maps, 42 sites were selected for surveys. Of these, thirty-two were sites with recent and/or historical records of rare species occurrences. Ten were newly selected sites that had not been previously inventoried for rare or uncommon species. Inaccessibility and anthropogenic disturbances such as agricultural conversion, shoreline development, residential development, and logging eliminated three sites. Seven sites containing Delmarva Bays were not surveyed due to excessive rainfall during the growing season. Draw down did not occur in these depressional wetlands thus prohibiting germination of the herbaceous layer. The remaining 32 sites (22 known, 10 new) were thoroughly surveyed; some several times due to size, complexity, and adverse weather conditions.

Site information packets were assembled for all of the 42 sites. Packets consisted of any records of rare species on or near the site, information on soil types and wetland regimes, photocopies of the appropriate topographic map, directions to the site, tax maps with the site marked, and the name and address of the landowner(s). Landowners were then contacted to arrange permission to visit the sites. The 2000 Caroline County field surveys initiated in early April and continued through late October.

Methods for field surveys follow those established by the Maryland Natural Heritage Program (see Ecologically Significant Areas in Charles and St. Mary's Counties, December 1995). At each site, data was collected concerning the general character of the site. The natural features of the site were described, noting the dominant vegetation, aquatic features, physical relief, and soil types. Any disturbances or threats to the integrity of the site were recorded. Natural communities were described and a list of the plant species was developed. Lastly, detailed information was recorded on the location, size, extent, condition, and specific habitat of any rare species population found at the site.

Results of the field surveys were reviewed in order to select sites determined to be ecologically significant based on the quality of the natural communities and the presence of rare species. Factors that were considered include the integrity of the community and the size and quality of populations of species designated as rare, threatened, or endangered in Maryland (see Rare, Threatened, and Endangered Plants of Maryland prepared by the Wildlife and Heritage Division, December 31, 1996). Based on these criteria, twenty-six sites were selected as protection areas for this report. In some cases, several sites were combined to make a larger protection area (e.g., Marshyhope Creek North). Nineteen are newly identified protection areas and seven are updates of existing protection areas. These sites are described in the following pages.

RESULTS AND DISCUSSION

Results of Surveys for Globally Rare Species

During the 2000 surveys, efforts to relocate the ten globally rare species known from Caroline County were unsuccessful. Only three of the ten globally rare species were successfully relocated. Among them are two occurrences of the globally rare, state endangered Creeping St. John's-wort *(Hypericum adpressum)*. One station of Creeping St. John's-wort was located in a Delmarva Bay and another station from wet, sandy soils bordering a mixed hardwood forest. The globally rare, state endangered Torrey's dropseed *(Muhlenbergia torreyana)* was successfully relocated in a Delmarva Bay at the Persimmon Preserve Site owned by The Nature Conservancy. This station of Torrey's dropseed represents the only known reported observation for this species in Maryland. The distribution of this species has significantly decreased and is currently known from only four states (MD, NJ, NC, TN). Records indicate that Torrey's dropseed was historically known from Delaware, Georgia, and New York. The globally rare, state threatened Awned mountain-mint *(Pycnanthemum setosum)* was successfully relocated in a powerline right-of-way during the 2000 surveys. In addition, two small colonies were newly discovered along a roadside and in a powerline right-of-way. Nine extant occurrences of Awned mountain-mint have been reported from the lower Coastal Plain of Maryland.

Results of Surveys for State Threatened and Endangered Species

Thirty-two species listed as threatened or endangered in Maryland were targeted for relocation during the 2000 surveys. Of the thirty-two species, nineteen are listed as endangered, and thirteen are considered threatened. Eight species listed as endangered in Maryland were successfully relocated. Included are state endangered species such as Striped gentian *(Gentiana villosa)*, Midland sedge *(Carex mesochorea)*, Velvety sedge *(Carex vestita)*, American waterwort *(Elatine americana)*, Torrey's dropseed, and Creeping St. John's-wort. The state threatened species successfully relocated include Single-headed pusssytoes *(Antennaria solitaria)*, Barratt's sedge *(Carex barrattii)*, White fringed orchid *(Platanthera blephariglottis)*, Awned mountain-mint, and Deciduous holly *(Ilex decidua)*.

Eight new occurrences of state threatened and endangered species were found during the 2000 surveys. Five of the eight occurrences were found in sites not previously surveyed, the remaining three new occurrences were located from established sites. Among them are two new occurrences for the globally rare, state threatened Awned mountain-mint, the state endangered Fibrous bladderwort *(Utricularia fibrosa)*, and the state endangered Slender nutrush *(Scleria minor)*. In addition, new stations for the state endangered Torrey's beakrush *(Rhynchospora torreyana)* and Louisiana sedge *(Carex louisianica)* was also reported. This is first reported observation of Torrey's beakrush and Slender nutrush in Caroline County.

Results of Surveys for State Rare and Watch List Species

Six species not officially listed as state threatened or endangered in Maryland, but are considered rare or uncommon by the Wildlife and Heritage Division were targeted for relocation. Three of the six species were successfully relocated and include the highly state rare Purple passionflower *(Passiflora incarnata)*, the state rare Tiny-headed beakrush *(Rhynchospora microcephala)*, and the watch list species Cat-tail sedge *(Carex typhina)*. A record for the highly state rare Mossy-cup oak *(Quercus macrocarpa)* along the Marshyhope Creek was determined to be a misidentification.

Nine new occurrences of rare or uncommon species were located during the 2000 surveys. Of significance is an occurrence of the highly state rare Rough hedge-nettle *(Stachys aspera)* from the Marshyhope Creek floodplain. Currently, this species is known from only one other location in Maryland (Marshyhope Creek, Dorchester County). In addition, the first reported observation of the highly state rare Tall nutrush *(Scleria triglomerata)* in Caroline County occurred during the 2000 surveys. Among the newly discovered watch list species are American chestnut *(Castanea dentate)*, Rose pogonia *(Pogonia ophioglossoides)*, Cat-tail sedge, Engelmann's spikerush *(Eleocharis engelmannii)*, Papillose nutrush *(Scleria pauciflora)*, and Clustered bluets *(Oldenlandia uniflora)*.

Discussion of Status Change for Some Species

In the winter of 1997, the staff of the Wildlife and Heritage Division met to review the rankings of species listed in Rare, Threatened, and Endangered Plants of Maryland, December 1996. As a result of extensive fieldwork over the last few years, many species were found to be more common than originally thought. Accordingly, species that had no official state status such as endangered or threatened have been downgraded. Currently, the Wildlife and Heritage Division is proposing that species being downgraded will also have the state status removed. Within this report, the following species is affected by ranking or status changes: Nuttall's tick-trefoil *(Desmodium nuttallii)*. These species are marked with a footnote in the **Rare and Uncommon Species Table** provided in each protection area summary.

Results of Newly Surveyed Sites

During the 2000 surveys, ten new sites were surveyed for rare species. Four of the ten sites contained rare or uncommon species. These sites yielded one globally rare species, three state endangered species, two highly state rare species, and three watch list species. Of the four sites, two are grassy roadside swales, one is from the Marshyhope Creek floodplain, and one is from a bog mat formation bordering an abandoned sandpit.

PROTECTION AREA SUMMARIES

CHOPTANK SANDPIT

Denton, MD USGS Quad

Ecological Significance

The Choptank Sandpit Protection Area is best characterized by a series of abandoned sand pits and sandy roads that are situated on the west side of the Choptank River just south of Greensboro. This site was found to support the state rare Spurred butterfly-pea *(Centrosema virginianum)* and Reflexed cyperus *(Cyperus refractus)* just south of the junction of Forge Branch and the Choptank River. The state rare Spurred butterfly-pea is known from fewer than ten extant stations throughout the state and is typically found in dry, sandy habitats. This habitat contains soils in which are typically nutrient-poor and have a low water retention capacity, thus providing harsh conditions for many plants. Leguminous species, such as the state rare Spurred butterfly-pea are specially adapted with the ability to fix nitrogen thus allowing survival in nutrient-poor soils. In addition, the state rare Reflexed cyperus is known from only five other locations in Maryland. Of the five known extant occurrences for Reflexed cyperus, two are located in Caroline County.

Rare and Uncommon Species Table

Scientific Name	Common Name	Status
Centrosema virginianum	Spurred butterfly-pea	State rare
Cyperus refractus	Reflexed cyperus	State rare

Threats and Management

The primary threat to the rare plant species growing in the xeric openings along the Choptank Sandpit Protection Area is road maintenance and development activities. Roadside mowing during the rare species' flowering and fruiting periods would inhibit reproduction and prevent population growth of these species. Some mowing has already occurred in areas near the rare plants. Mowing should be conducted only early in the season before the rare plant species appear or late in the year after the fruiting period. If herbicide is used in this protection area, it should be carefully applied to avoid the rare species and their associated habitat. Additionally, any road maintenance or improvement in the areas with rare plants could threaten their existence. It is strongly recommended

that all development activities be kept at a minimum near this sensitive roadside site so as not to endanger the rare plant species.

Boundary Recommendations

The Choptank Sandpit Protection Area boundary extends south from the junction of Forge Branch for approximately 1.2 km to a smaller, unnamed tributary of the Choptank River. Bound to the east by the Choptank River and to the west by a series of sandpits, this linear protection area has been designed to include all of the rare species' required habitat and additional buffer.

Site Description

Located just south of Greensboro, the Choptank Sandpit Protection Area consists of a series of abandoned sandpits and sandy access roads. Although disturbed, the perimeter of the sandpits support many plant species in which have adapted to the dry and nutrient-poor soils. Leguminous species such as the state rare Spurred butterfly-pea and several species of Tick-trefoils *(Desmodium* spp*.)* and Lespedeza *(Lespedeza* spp*.)* occupy a small portion of the ground layer. The ground layer is also comprised of a wide variety of grasses and sedges of which include the state rare Reflexed cyperus.

CAROLINE COUNTY DELMARVA BAYS

Goldsboro, MD USGS Quad

Ecological Significance

Delmarva Bays are centripetally drained, depressional wetlands that range from one to fifteen acres in surface area, and often hold up to four feet of water in the spring. Seasonal fluctuations in groundwater recharge and precipitation cause these wetlands to be irregularly flooded or seasonally inundated. Delmarva Bays are often void of surface water during very dry seasons or have standing water much reduced to a smaller area at the deepest point within the bay. Based on water levels during the growing season, changes in vegetation or community structure are often exhibited as concentric rings around the pond perimeter –with community changes progressing to the center or lowest point within the interior of the pond (Berdine, 1998). This unique wetland habitat is restricted to five counties on the Lower Coastal Plain of Maryland. Seasonal ponds such as those in Caroline County often contain rare, disjunct, or endemic species and are considered unique because they are among the few remaining naturally open freshwater wetlands on the Coastal Plain.

Significant rainfall amounts during the 2000 growing season inhibited draw down in virtually all of the Delmarva Bays surveyed. Prolonged inundation prohibited the germination of the herbaceous plant communities and rare plant species within those bays. Several of the bays were periodically visited to verify water levels throughout October. Information in this report has been compiled from surveys completed in 1987, 1992, and 1995.

Several Delmarva Bays in Caroline County are known to support the globally rare, state endangered Harper's Fimbristylis *(Fimbristylis perpusilla)*. Currently there are nineteen extant occurrences of this species in Maryland. Harper's Fimbristylis is a regional endemic of the lower Coastal Plain from Delaware to Georgia. This species is restricted to areas in ponds and rivers that are exposed, but desiccated, during low-water periods. Many of these habitats are fragile, susceptible to hydrological disturbances (NatureServe, 2000). Another globally rare, state endangered species known from Delmarva Bays in Caroline County is Creeping St. John's-wort *(Hypericum adpressum)*. Creeping St. John's-wort is currently known from eight extant locations in Maryland, two of which are in Caroline County. During the 2000 surveys, the largest recorded population of Creeping St. John's-wort in Maryland was relocated at Mount Zion South Pond. This species' range includes most of the eastern portion of the United States but populations are widely scattered across that range. It is not common in any state, and has been extirpated or possibly extirpated in at least five states. The species has a specific habitat preference (seasonal, ground water-driven depressional wetlands); this habitat is sensitive to disturbance and is frequently threatened by draining and filling for agriculture and development (NatureServe, 2000).

The only known extant occurrences of two globally rare, state endangered species, Rose Coreopsis *(Coreopsis rosea)* and Torrey's dropseed *(Muhlenbergia torreyana)* have been

reported from two Caroline County Delmarva Bays (Schuyler Road Pond and Persimmon Preserve Site). Torrey's dropseed was relocated during the 2000 surveys in a bay at the Persimmon Preserve Site. In addition, several other state endangered species have been observed in Delmarva Bays throughout Caroline County. Among them are Black-fruited spikerush *(Eleocharis melanocarpa)*, Featherfoil *(Hottonia inflata)*, Walter's paspalum *(Paspalum dissectum)*, Fibrous bladderwort *(Utricularia fibrosa)*, Aster-like boltonia *(Boltonia asteroides)*, Sharp-scaled mannagrass *(Glyceria acutiflora)*, and Coppery St. John's-wort *(Hypericum denticulatum)*. All of the state endangered species reported from Delmarva Bays are known from fewer than ten stations in Maryland. State threatened species reported include Long-beaked baldrush *(Rhynchospora scirpoides)*, Purple bladderwort *(Utricularia purpurea)*, and Engelmann's arrowhead *(Sagittaria engelmanniana)*. The globally rare, state rare Reticulated nutrush *(Scleria reticularis)* and the watch list species, Clustered bluets *(Oldenlandia uniflora)* have also been reported at several of the sites listed below.

Rare and Uncommon Species Table

Site Name	Scientific Name	Common Name	Status
Baltimore Corner Preserve	*Boltonia asteroides*	Aster-like boltonia	Endangered
	Panicum hemitomon	Maidencane	Watch list
	Paspalum dissectum	Walter's paspalum	Endangered
	Rhynchospora scirpoides	Long-beaked baldrush	Threatened
	Scleria reticularis	Reticulated nutrush	State rare
	Utricularia purpurea	Purple bladderwort	Threatened
Bridgetown Ponds	*Fimbristylis perpusilla*	Harper's fimbristylis	Globally rare, Endangered
	Panicum hemitomon	Maidencane	Watch list
	Rhynchospora scirpoides	Long-beaked baldrush	Threatened
	Scleria reticularis	Reticulated nutrush	State rare
East Melville Pond	*Fimbristylis perpusilla*	Harper's fimbristylis	Globally rare, Endangered
	Oldenlandia uniflora	Clustered bluets	Watch list
	Panicum hemitomon	Maidencane	Watch list
	Paspalum dissectum	Walter's paspalum	Endangered
Greer's Pond	*Fimbristylis perpusilla*	Harper's fimbristylis	Globally rare, Endangered
	Panicum hemitomon	Maidencane	Watch list
	Scleria reticularis	Reticulated nutrush	State rare
Hollingsworth Ponds	*Fimbristylis perpusilla*	Harper's fimbristylis	Globally rare, Endangered
	Glyceria acutiflora	Sharp-scaled mannagrass	Endangered
	Hottonia inflata	Featherfoil	Endangered
	Scleria reticularis	Reticulated nutrush	State rare
	Utricularia fibrosa	Fibrous bladderwort	Endangered
Jackson Lane Site	*Boltonia asteroides*	Aster-like boltonia	Endangered
	Eleocharis melanocarpa	Black-fruited spikerush	Endangered
	Fimbristylis perpusilla	Harper's fimbristylis	Globally rare, Endangered
	Hottonia inflata	Featherfoil	Endangered
	Hypericum denticulatum	Coppery St. John's-wort	Endangered
	Oldenlandia uniflora	Clustered bluets	Watch list

Mount Zion South Pond	*Boltonia asteroides*	Aster-like boltonia	Endangered
	Sagittaria engelmanniana	Engelmann's arrowhead	Threatened
	Hypericum adpressum	Creeping St. John's-wort	Globally rare, Endangered
Persimmon Preserve Site	*Fimbristylis perpusilla*	Harper's fimbristylis	Globally rare, Endangered
	Muhlenbergia torreyana	Torrey's dropseed	Endangered
	Paspalum dissectum	Walter's paspalum	Endangered
	Sagittaria engelmanniana	Engelmann's arrowhead	Threatened
	Scleria reticularis	Reticulated nutrush	State rare
R and M Bay	*Fimbristylis perpusilla*	Harper's fimbristylis	Globally rare, Endangered
Schuyler Road Pond	*Coreopsis rosea*	Rose coreopsis	Endangered

Threats and Management

Delmarva Bays in Maryland suffer from many significant abiotic and biotic threats. The primary threat to all of these systems is hydrologic alteration of the ground water. Lowering the ground water table promotes an increase in woody plant invasion and results in the succession of herbaceous community types to shrub and forested types (Berdine, 1998). Woody plant succession is often detrimental to many of the rare plant species restricted to Delmarva Bays. Sources of hydrologic alterations are mainly those of agricultural activities in which include ditching, draining, logging, conversion to cropland, and pumping for irrigation purposes. It is highly recommended that these activities be avoided in the protection areas listed below.

A management plan incorporating rare species protection is highly recommended for these protection areas. Future management objectives should incorporate the monitoring of rare species, plant community dynamics, woody plant succession, and most of all, hydrological changes. Any plans for ditching, draining, and logging on adjacent lands should be carefully reviewed in order to assess the impacts on hydrology and the rare species. Based on the ecological sensitivity, it is strongly suggested that access to these sites remain restricted. Except for Hollingsworth Ponds, all of the sites mentioned below are currently recognized as a Nontidal Wetland of Special State Concern under the State's Nontidal Wetlands Regulations (see Appendix II). This designation requires that proposed disturbances be reviewed for the potential to adversely impact a habitat containing rare species and that such impacts be avoided or minimized. In order to ensure adequate protection for this site, it is strongly recommended that this designation remain. It is also recommended that the Hollingsworth Ponds Protection Area be designated as a Nontidal Wetland of Special State Concern.

Boundary Recommendations

The protection area boundaries for the sites listed below have been designed to include the rare species habitat and additional forested buffer required to maintain the current hydrological regime.

Site Description

Baltimore Corner Preserve- *Goldsboro, MD USGS Quad*

The Baltimore Corner Preserve is a complex of Delmarva Bays, naturally seasonally flooded ponds currently owned and managed by The Nature Conservancy. This system contains ponds varying in size from a half to three acres in surface area. Occurring throughout the ponds are concentric zones of vegetation. The outermost zone in several of the ponds is dominated by dense growth of Buttonbush *(Cephalanthus occidentalis)* and Maidencane *(Panicum hemitomon)*. Vegetation in the interior and lowest point in two of the ponds is comprised of Eaton's panicgrass *(Panicum spretum)*, Warty panicgrass *(Panicum verrucosum)*, Slender fimbristylis *(Fimbristylis autumnalis)*, and Virginia meadow-beauty *(Rhexia virginica)*. The edge of the largest pond is occupied by Buttonbush and Virginia chain fern *(Woodwardia virginica)* while the interior is dominated by Walter's sedge *(Carex striata* var. *brevis)*. The Baltimore Corner Preserve contains many rare and uncommon plants that are restricted to this habitat type in Maryland. Included is the state endangered Aster-like boltonia *(Boltonia asteroides)*, the state endangered Walter's paspalum *(Paspalum dissectum)*, and the state rare Reticulated nutrush *(Scleria reticularis)*. State threatened species known from this complex include Long-beaked baldrush *(Rhynchospora scirpoides)* and the floating, carnivorous Purple bladderwort *(Utricularia purpurea)*. During very wet seasons, this pond may contain as much as two feet of water and support an array of emergent wetland plants.

Bordering this complex is a forest of Sweet gum *(Liquidambar styraciflua)*, Red maple *(Acer rubrum)*, and Black gum *(Nyssa sylvatica)*. The understory is comprised of Sweet pepperbush *(Clethra alnifolia)*, American holly *(Ilex opaca)*, and dense thickets of Common greenbrier *(Smilax rotundifolia)*.

Bridgetown Ponds- *Goldsboro, MD USGS Quad*

Bridgetown Ponds contains a series of Delmarva Bays in which support populations of the globally rare Harper's fimbristylis *(Fimbristylis perpusilla)*, the state threatened Long-beaked baldrush *(Rhynchospora scirpoides)*, and the state rare Reticulated nutrush *(Scleria reticularis)*. The majority of the ponds in this complex are dominated by herbaceous vegetation consisting of Virginia meadow-beauty *(Rhexia virginica)*, Warty panicgrass *(Panicum verrucosum)*, and the state rare Reticulated nutrush. The globally rare Harper's fimbristylis, state threatened Long-beaked baldrush, Slender fimbristylis *(Fimbristylis autumnalis)*, Beggar-ticks *(Bidens frondosa)*, Dwarf St. John's-wort *(Hypericum mutilum)* occur in lesser numbers throughout this zone. These plants were observed to be growing near the center or lowest point of the ponds. The outermost zones of vegetation consisted of species such as Maidencane *(Panicum hemitomon)*, Eaton's panicgrass *(Panicum spretum)*, Warty panicgrass, Horned rush *(Rhynchospora macrostachya)*, and shrubs of Persimmon *(Diospyros virginiana)* and Buttonbush *(Cephalanthus occidentalis)*. Bordering this complex is a forest of Sweet gum *(Liquidambar styraciflua)*, Black gum *(Nyssa sylvatica)*, Southern red oak *(Quercus falcata)*, Loblolly pine *(Pinus taeda)*, Sweet bay *(Magnolia virginiana)*, Sassafras

(Sassafras albidum), and Red maple *(Acer rubrum)*. The shrub layer contains species such as American holly *(Ilex opaca)*, Swamp azalea *(Rhododendron viscosum)*, Sweet pepperbush *(Clethra alnifolia)*, Highbush blueberry *(Vaccinium corymbosum)*, and Fetterbush *(Leucothoe racemosa)*.

East Melville Pond- *Goldsboro, MD USGS Quad*

Just east of Melville Crossroads is a small Delmarva Bay approximately one acre in size that supports the globally rare Harper's fimbristylis *(Fimbristylis perpusilla)* and the state endangered Walter's paspalum *(Paspalum dissectum)*. This site also supports two watch list species, Clustered bluets *(Oldenlandia uniflora)* and Maidencane *(Panicum hemitomon)*. This oval shaped seasonal pond is dominated by scattered clumps of Buttonbush *(Cephalanthus occidentalis)*, Swamp loosestrife *(Decodon verticillatus)* and Beggar-ticks *(Bidens frondosa)*. Openings in the pond basin were found to support Harper's fimbristylis, Walter's paspalum, and Clustered bluets. Dense patches of Maidencane occupy the northern and southern edges of East Melville Pond. Bordering the pond to the east is a young forest of Willow oak *(Quercus phellos)*, Red maple *(Acer rubrum)*, and Sweet gum *(Liquidambar styraciflua)*. The northern end of East Melville Pond lies in close proximity to Bee Tree Road and lacks a substantial forested buffer, as does the southern and western sides in which are bordered by agricultural fields.

Greer's Pond- *Goldsboro, MD USGS Quad*

Greer's Pond is a 25-acre complex of naturally seasonally flooded ponds or Delmarva Bays located northeast of Mount Zion. The largest pond contains a small opening in the center or lowest point in which harbors the globally rare Harper's fimbristylis *(Fimbristylis perpusilla)*, the state rare Reticulated nutrush *(Scleria reticularis)*, and Maidencane *(Panicum hemitomon)*, a watch list species. This herbaceous opening is dominated by Warty panicgrass *(Panicum verrucosum)* and Plume grass *(Erianthus giganteus)*. Associated with these species are Eaton's panicgrass *(Panicum spretum)*, Virginia meadow-beauty *(Rhexia virginica)*, Walter's sedge *(Carex striata* var. *brevis)*, Twigrush *(Cladium mariscoides)*, Maidencane, Marsh St. John's-wort *(Hypericum virginicum)*, and scattered shrubs of Buttonbush *(Cephalanthus occidentalis)*. Advanced woody plant succession occurs around the edges of the opening and is primarily composed of Red maple *(Acer rubrum)* and Sweet gum *(Liquidambar styraciflua)* saplings. The forest surrounding this complex is dominated by Sweet gum, Red maple, and Willow oak *(Quercus phellos)*. The understory contains Sweet bay *(Magnolia virginiana)*, Buttonbush, Fetterbush *(Leucothoe racemosa)*, Sweet pepperbush *(Clethra alnifolia)*, pockets of Sphagnum moss *(Sphagnum* sp.*)*, and thickets of Common greenbrier *(Smilax rotundifolia)*. Agricultural fields lie south of the ponds.

Hollingsworth Ponds- *Goldsboro, MD USGS Quad*

Located just south of Baltimore Corner is a Delmarva Bay complex named Hollingsworth Ponds. This complex contains several seasonally flooded ponds embedded in a palustrine forest matrix of Loblolly pine *(Pinus taeda)*, Sweet gum *(Liquidambar styraciflua)*,

Black gum *(Nyssa sylvatica)*, Red maple *(Acer rubrum)*, and Sweet pepperbush *(Clethra alnifolia)*. Most of the ponds herbaceous layer is comprised of Walter's sedge *(Carex striata* var. *brevis)* and Virginia meadow-beauty *(Rhexia virginica)*. Seven rare or uncommon plant species are known from this complex and include species such as the globally rare, Harper's fimbristylis *(Fimbristylis perpusilla)*, the state rare Reticulated nutrush *(Scleria reticularis)*, and the highly state rare Hop-like sedge *(Carex lupuliformis)*. The state endangered species known from this site include Sharp-scaled mannagrass *(Glyceria acutiflora)*, Featherfoil *(Hottonia inflata)*, Walter's paspalum *(Paspalum dissectum)*, and Fibrous bladderwort *(Utricularia fibrosa)*.

Jackson Lane Preserve- *Goldsboro, MD USGS Quad*

The Jackson Lane Preserve is a complex of Delmarva Bays currently owned and managed by The Nature Conservancy. Varying in size, the ponds are bordered by a high quality palustrine forest of Sweet gum *(Liquidambar styraciflua)*, Black gum *(Nyssa sylvatica)*, Red maple *(Acer rubrum)*, and Sweet pepperbush *(Clethra alnifolia)*. Within the ponds, there are three different types of herbaceous plant communities in which support one globally rare, four state endangered, and one watch list plant species. Among them are the globally rare, Harper's fimbristylis *(Fimbristylis perpusilla)* and Clustered bluets *(Oldenlandia uniflora)*, a watch list species. The state endangered species known from this site include Featherfoil *(Hottonia inflata)*, Aster-like boltonia *(Boltonia asteroides)*, Black-fruited spikerush *(Eleocharis melanocarpa)*, and Coppery St. John's-wort *(Hypericum denticulatum)*. Of the three herbaceous community types associated with this complex there is one dominated by Long-leaved panicgrass *(Panicum longifolium)*, Clustered bluets, Water smartweed *(Polygonum amphibium)*, Mild water pepper *(Polygonum hydropiperoides)*, and Sphagnum moss *(Sphagnum* sp.*)*. The remaining two types are independently dominated by Virginia chain fern *(Woodwardia virginica)* and Walter's sedge *(Carex striata* var. *brevis)*. Buttonbush *(Cephalanthus occidentalis)* can also be found in lesser numbers scattered throughout the basin and perimeter of the ponds.

Mount Zion South Pond- *Goldsboro, MD USGS Quad*

Just south of Mount Zion is a small Delmarva Bay that supports the globally rare state endangered Creeping St. John's-wort *(Hypericum adpressum)*, state endangered Aster-like boltonia *(Boltonia asteroides)*, and the state threatened Engelmann's arrowhead *(Sagittaria engelmanniana)*. The herbaceous vegetation in the pond is dominated by Long-leaved panicgrass *(Panicum longifolium)*, Maryland meadow-beauty *(Rhexia mariana)*, Small-headed beakrush *(Rhynchospora capitellata)*, and Hyssop-leaved boneset *(Eupatorium hyssopifolium)*. The deepest portion of the pond is dominated by Pickerelweed *(Pontederia cordata)*, Water smartweed *(Polygonum amphibium)*, Sharp-fruited rush *(Juncus acuminatus)*, and scattered shrubs of Steeplebush *(Spirea tomentosa)* and Buttonbush *(Cephalanthus occidentalis)*. Agricultural fields adjoin the north, south, and east sides of the pond with virtually no vegetated buffer between them. The western portion gradually tapers towards a palustrine forest of Red maple *(Acer rubrum)*, Sweet gum *(Liquidambar styraciflua)*, and a variety of oaks *(Quercus* spp.*)*.

Persimmon Preserve Site- *Goldsboro, MD USGS Quad*

The Persimmon Preserve Site contains a large Delmarva Bay or seasonal pond in which is the focus of this 25-acre protection area. This Delmarva Bay supports a host of rare plants that include the globally rare, Harper's fimbristylis *(Fimbristylis perpusilla)*, the state endangered Torrey's dropseed *(Muhlenbergia torreyana)*, the state endangered Walter's paspalum *(Paspalum dissectum)*, the state threatened Engelmann's arrowhead *(Sagittaria engelmanniana)*, the state rare Reticulated nutrush *(Scleria reticularis)*, and the watch list species, Clustered bluets *(Oldenlandia uniflora)*. The center of this seasonal pond is a sedge glade, primarily of Walter's sedge *(Carex striata* var. *brevis)* and Twigrush *(Cladium mariscoides)*. Small stands of Water willow *(Justicia Americana)* occur at the northern and southern edges of the pond. Three-way sedge *(Dulichium arundinaceum)* is dense within an irregular depression at the southern end of the pond. Four of the rare species occur in or near this depression. Seedlings and saplings of Red maple *(Acer rubrum)* and Sweet gum *(Liquidambar styraciflua)* occur near the pond edge and in isolated stands within the pond. These tree species, plus Fetterbush *(Leucothoe racemosa)* and Common greenbrier *(Smilax rotundifolia)*, dominate the forest immediately surrounding the pond. Southwest of the pond is a Loblolly pine *(Pinus taeda)* plantation. There is little variation in the topography of the land surrounding much of the pond. Slopes of erodible soils northwest of the pond are the only significant features.

R and M Bay- *Goldsboro, MD USGS Quad*

Within a large, hardwood swamp forest is a two acre seasonal pond dominated by herbaceous species. Agricultural ditching and drainage have destroyed many similar ponds on the Eastern Shore. The abundance of herbaceous vegetation in the pond's center is maintained by the fluctuating groundwater regime. Normally, the water level is highest in spring and the pond gradually dries through the summer. This pond has an unusual hourglass shape with deep depressions at both ends. Many herbaceous species germinate in these depressions after the pond dries and complete their life cycles in the brief period before the fall frosts.

This 135-acre freshwater wetland complex is comprised of hardwood swamp forests intertwined by areas of upland hardwood forests. Seasonal ponds dominated by trees and shrubs are scattered through the swamp forest. R and M Bay is a large and hourglass-shaped pond with shallow depressions at both ends. The deepest section supports a small colony of the globally rare Harper's fimbristylis *(Fimbristylis perpusilla)*. A glade of sedges covers the eastern half and the narrow neck of the hourglass. Buttonbush *(Cephalanthus occidentalis)* dominates the center of the western half, and grasses grow under and around these shrubs. A powerline lies about 100 feet west of the pond; beyond the powerline are cultivated fields. There are cultivated fields to the south approximately 1000 feet from the pond, and to the north and east approximately 2000 feet from the pond.

Schuyler Road Pond- *Goldsboro, MD USGS Quad*

This 1.5-acre seasonal pond contains Maryland's only known population of the state endangered, Rose coreopsis *(Coreopsis rosea)*. This species was thought to have been extirpated from Maryland until its discovery in 1987. Rose coreopsis is also very rare in surrounding states. The population in Schuyler Road Pond is large and was flowering profusely at the time of the site visit, indicating that the population is well established.

The seasonal pond was deepened by excavation over 25 years ago. A dense mat of Sphagnum moss *(Sphagnum* sp.*)* occurs along the outer edge of the pond, suggesting that this region was not severely disturbed during excavation. Many similar ponds have been destroyed by agricultural ditching and drainage. In addition, trees or shrubs dominate most of the remaining seasonal ponds, while this pond is a grassy glade in late summer. Fluctuating groundwater level maintains this abundance of herbaceous vegetation. The pond's water level is highest in the spring, then recedes, and the pond dries in the summer.

This 45-acre protection area incorporates a 1.5-acre seasonal pond dominated by grasses in the center and composites (sunflower-like plants) along the edge. The state endangered Rose coreopsis emerges from mats of Sphagnum moss along the pond perimeter. Its delicate, pink flowers brighten the meadow-like vegetation of the pond in late summer. Unlike many other rare species that inhabit seasonal ponds, Rose coreopsis is perennial and is able to reproduce vegetatively. Therefore, this species flowers and fruits in years of drought as well as in years of excessive rain. However, population size has been reported to vary with water depth, thus revealing the importance of maintaining the current groundwater regime. Surrounding the pond are cultivated fields. A large tract of forest lies approximately 300 feet east of the pond.

CAROLINE COUNTY ROADSIDES

Denton and Goldsboro, MD USGS Quads

Ecological Significance

Adjacent to many of the sandy roads in Caroline County are small grassy swales and seasonally wet ditches that support numerous rare plant species. Included from the Mint family are the globally rare, state endangered Torrey's mountain-mint *(Pycnanthemum torrei)* and the globally rare, state threatened Awned mountain-mint *(Pycnanthemum setosum)*. This habitat also supports five state endangered species, two state threatened species, one highly state rare species, and one watch list species. Updated from previous records are three occurrences for the state endangered Velvety sedge *(Carex vestita)*, one occurrence of the state endangered Midland sedge *(Carex mesochorea)*, and one occurrence of the state threatened Woolly sedge *(Carex pellita)*.

Newly discovered occurrences include the state endangered Torrey's beakrush *(Rhynchospora torreyana)*, the state endangered Slender nutrush *(Scleria minor)*, the highly state rare Tall nutrush *(Scleria triglomerata)*, and Papillose nutrush *(Scleria pauciflora)*, a watch list species. This is the first reported observation of Torrey's beakrush in Caroline County. Prior to the 2000 surveys, Slender nutrush was not known from Caroline County. Currently, there are only eight known extant occurrence of Slender nutrush in Maryland. In addition, the state endangered Striped gentian *(Gentiana villosa)* and the state threatened White fringed orchid *(Platanthera blephariglottis)* were successfully relocated during the 2000 surveys. There are numerous historical records in the Piedmont and upper Coastal Plain for Striped gentian dating back to the late 1800's. This population represents the fourth known extant occurrence of Striped gentian in Maryland and the only known location for this species on the lower Coastal Plain.

Rare and Uncommon Species Table

Site Name	Scientific Name	Common Name	Status
Airport Swale	*Rhynchospora torreyana*	Torrey's beakrush	Endangered
	Scleria minor	Slender nutrush	Endangered
	Scleria pauciflora	Papillose nutrush	Watch list
Hog Lot Roadside	*Carex vestita*	Velvety sedge	Endangered
Jones Roadside	*Platanthera blephariglottis*	White fringed orchid	Threatened
	Pycnanthemum setosum	Awned mountain-mint	Globally rare, Threatened
	Scleria pauciflora	Papillose nutrush	Watch list
	Scleria triglomerata	Tall nutrush	Highly State rare
Kibler Roadside	*Carex pellita*	Woolly sedge	Threatened
Lentz-Steele Roadside	*Gentiana villosa*	Striped gentian	Endangered
	Desmodium nuttallii	Nuttall's tick-trefoil	Status unknown[1]
	Carex mesochorea	Midland sedge	Endangered
	Carex vestita	Velvety sedge	Endangered
Marble Head Road Swales	*Carex vestita*	Velvety sedge	Endangered
	Pycnanthemum torrei	Torrey's mountain-mint	Globally rare, Endangered

Threats and Management

Road maintenance and development activities are the primary threat for these roadside sites. Roadside mowing during the rare species flowering and fruiting periods would inhibit reproduction and prevent population growth of these species. Mowing should be conducted only early in the season before the rare plant species appear or late in the year after their fruiting periods. If herbicide is used at these roadside sites, it should be selectively applied to avoid the rare species and their associated habitat. Additionally, any road maintenance or improvement such as salting, snow plowing, widening, and paving in the areas with rare plants could threaten their existence. It is strongly recommended that all development activities be kept at a minimum near these sensitive roadside sites so as not to endanger the rare plant species. Contact should be maintained between Caroline County, the Maryland Department of Natural Resources, and the Maryland State Highway Administration to ensure that maintenance projects be reviewed to assess potential impacts to the rare species and their habitats.

Boundary Recommendations

The protection area boundaries for the roadside sites have been designed to include all of the rare species required habitat and additional buffer.

[1] Current status of this species is unknown and under review by the Wildlife and Heritage Division.

Site Descriptions

Airport Swale- *Denton, MD USGS Quad*

This site contains a narrow "prairie-like" grassland community dominated by Little bluestem *(Schizachyrium scoparium)*, Yellow indiangrass *(Sorghastrum nutans)*, and Velvety panicgrass *(Panicum scoparium)*. Situated on seasonally wet sandy soils, this site harbors the state endangered Torrey's beakrush *(Rhynchospora torreyana)*, the state endangered Slender nutrush *(Scleria minor)*, and the watch list species Papillose nutrush *(Scleria pauciflora)*. In wetter portions of this site grow Fox-tail clubmoss *(Lycopodiella alopecuroides)* and Sphagnum moss *(Sphagnum* sp.*)*. In addition to the rare plant species mentioned, this tallgrass plant community contains a mixture of sedges and rushes that include species such as Scirpus-like rush *(Juncus scirpoides)* and Small-headed beakrush *(Rhynchospora capitellata)*. Forbs occupying a small percentage of this herbaceous plant community include Nuttall's lobelia *(Lobelia nuttallii)*, Hyssop-leaved boneset *(Eupatorium hyssopifolium)*, Sweet goldenrod *(Solidago odora)*, Rough-stemmed goldenrod *(Solidago rugosa)*, and Purple gerardia *(Agalinis purpurea)*. To the south, this site is bound by a mixed deciduous forest of oaks, Sweet gum, and Red maple dissected by two unnamed streams. Advanced Sweet gum sapling succession is occurs in the transitional zone between the forest and herbaceous plant community.

Hog Lot Roadside- *Denton, MD USGS Quad*

This roadside site contains a small population of the state endangered Velvety sedge *(Carex vestita)* bordering a ditch adjacent to Hog Lot Road. Species associated with this occurrence include Kentucky bluegrass *(Poa pratensis)*, Lanced-leaved violet *(Viola lanceolata)*, Whorled loosestrife *(Lysimachia quadrifolia)*, and Cow-wheat *(Melampyrum lineare)*. Immediately adjacent to this ditch is a mixed-deciduous forest with a canopy of White oak *(Quercus alba)*, Red oak *(Quercus rubra)*, Willow oak *(Quercus phellos)*, and Sweet gum *(Liquidambar styraciflua)*. Subcanopy species include Red maple *(Acer rubrum)*, American holly *(Ilex opaca)*, and Sassafras *(Sassafras albidum)* with a shrub layer dominated by dense thickets of Sweet pepperbush *(Clethra alnifolia)* and Common greenbrier *(Smilax rotundifolia)*.

Jones Road- *Goldsboro, MD USGS Quad*

A seasonally wet and sandy roadside shoulder along Jones Road was found to support new occurrences of the globally rare, state threatened Awned mountain-mint *(Pycnanthemum setosum)* and White fringed orchid *(Platanthera blephariglottis)*, as well as the highly state rare Tall nutrush *(Scleria triglomerata)* and the watch list species Papillose nutrush *(Scleria pauciflora)*. Accompanying these species are Flat-topped aster *(Aster umbellatus)*, Downy lobelia *(Lobelia puberula)*, Slender fimbristylis *(Fimbristylis autumnalis)*, and Narrow-leaved sunflower *(Helianthus angustifolius)*. This site is bordered by mixed hardwood swamp forests dominated by Sweet gum *(Liquidambar styraciflua)*, Black gum *(Nyssa sylvatica)* and a variety of oaks. The Nature Conservancy owns a large tract east of this roadside site.

Kibler Road- *Denton, MD USGS Quad*

The Kibler Road site consists of seasonally wet ditch and woods edge habitat that supports an occurrence of the state threatened Woolly sedge *(Carex pellita)*. Herbaceous plant species associated with the Woolly sedge include Sweet vernal grass *(Anthoxanthum odoratum)*, Common rush *(Juncus effusus)*, Wool-grass *(Scirpus cyperinus)*, White-edge sedge *(Carex debilis)*, and Blue-eyed grass *(Sisyrinchium* sp.*)*. Bordering the ditch is a dry-mesic mixed evergreen-deciduous forest of White oak *(Quercus alba)*, Willow oak *(Quercus phellos)*, Loblolly pine *(Pinus taeda)*, Virginia pine *(Pinus virginiana)*, Sweet gum *(Liquidambar styraciflua)*, and Red maple *(Acer rubrum)*. Understory species include species such as Sweet pepperbush *(Clethra alnifolia)*, Highbush blueberry *(Vaccinium corymbosum)*, American holly *(Ilex opaca)*, and the invasive Multiflora rose *(Rosa multiflora)*.

Lentz-Steele Roadside- *Goldsboro, MD USGS Quad*

A wide maintained shoulder paralleling Lentz Road was found to support the state endangered Striped gentian *(Gentiana villosa)*, Midland sedge *(Carex mesochorea)*, and Velvety sedge *(C. vestita)*. Periodic mowing has suppressed most woody growth at this site thus allowing for a diverse assemblage of herbaceous species to thrive. Numerous grasses, sedges, and tick-trefoils are found scattered throughout dense Bracken fern *(Pteridium aquilinum)* growth on the dry sandy soil. Species observed include Swan's sedge *(C. swanii)*, Pointed broom sedge *(C. scoparia)*, White-edge sedge *(C. debilis)*, Purple lovegrass *(Eragrostis purpurea)*, Meadow fescue *(Festuca elatior)*, Panicled tick-trefoil *(Desmodium paniculatum)*, and Hairy small-leaved tick-trefoil *(Desmodium ciliare)*. A mixed evergreen-hardwood forest dominated by White oak *(Quercus alba)*, Willow oak *(Q. phellos)*, Red maple *(Acer rubrum)*, Sweet gum *(Liquidambar styraciflua)*, and Virginia pine *(Pinus virginiana)* borders this site. The understory is comprised of American holly *(Ilex opaca)*, Common greenbrier *(Smilax rotundifolia)*, Sassafras *(Sassafras albidum)*, Winterberry *(I. verticillata)*, and Southern arrowwood *(Viburnum dentatum)*.

Marble Head Swales- *Denton, MD USGS Quad*

Two areas along the sandy Marble Head Road were found to support an occurrence of the globally rare, state endangered Torrey's mountain-mint *(Pycnanthemum torrei)* and the state endangered Velvety sedge *(Carex vestita)*. Torrey's mountain-mint was located in a grassy swale lying between an agricultural field and a ditch. Species associated with this habitat include Whorled mountain-mint *(P. verticillatum)*, Maryland meadow-beauty *(Rhexia mariana)*, Meadow fescue *(Festuca elatior)*, Common ragweed *(Ambrosia artemisifolia)*, and Purple lovegrass *(Eragrostis purpurea)*. Portions of Marble Head Road are bordered by forests of White oak *(Quercus alba)*, Willow oak *(Q. phellos)*, Southern red oak *(Q. falcata)*, Red maple *(Acer rubrum)*, Sweet gum *(Liquidambar styraciflua)*, and Black gum *(Nyssa sylvatica)*. Much of the forests have been recently logged. The low-lying edges of these forests support species such as Sweet pepperbush

(Clethra alnifolia), Common greenbrier *(Smilax rotundifolia)*, Highbush blueberry *(Vaccinium corymbosum)*, and patches of the state endangered Velvety sedge.

FLORAL SWALE

Goldsboro, MD USGS Quad

Ecological Significance

Powerline right-of-ways have become significant habitat for a large number of threatened and endangered plant species in Maryland, especially those that require an open canopy. Historically, the major sources of natural forest canopy removal were forest fire and beaver activity. However, natural forest openings are now uncommon due to modern fire suppression practices, and the beaver populations on the Eastern Shore have been decimated.

The Floral Swale Protection Area was found to support an occurrence of the globally rare, state endangered Creeping St. John's-wort *(Hypericum adpressum)* and the globally rare, state threatened Awned mountain-mint *(Pycnanthemum setosum)*. Distribution for Creeping St. John's-wort includes most of the eastern portion of the United States but populations are widely scattered across that range (NatureServe, 2000). It is not common in any state, and has been extirpated or possibly extirpated in at least five states (CT, KY, MO, NC, PA). In Maryland, Creeping St. John's is known from only eight extant locations. The newly discovered occurrence of Awned mountain-mint during the 2000 surveys represents the eighth extant occurrence of this species in Maryland. Watch list species located in the Floral Swale Protection Area include Engelmann's spikerush *(Eleocharis engelmannii)* and Clustered bluets *(Oldenlandia uniflora)*.

Rare and Uncommon Species Table

Scientific Name	Common Name	Status
Eleocharis engelmannii	Engelmann's spikerush	Watch list
Hypericum adpressum	Creeping St. John's-wort	Globally rare, Endangered
Oldenlandia uniflora	Clustered bluets	Watch list
Pycnanthemum setosum	Awned mountain-mint	Globally rare, Threatened

Threats and Management

A large part of the powerline right-of-way that comprises the Floral Swale Protection Area has been converted for agricultural use. The remaining habitat is limited, however, very critical in sustaining the rare plant populations. It is highly recommended that no further reduction of available habitat occur. In addition, the globally rare, state endangered Creeping St. John's-wort requires seasonally saturated soils to thrive. Hydrologic alterations resulting from agricultural activities such as discing, ditch diversion, and ditch draining could upset the hydrological balance and decimate the rare plant populations. Due to the close proximity of the rare plants to the agricultural fields, herbicidal applications are of great concern. Herbicide use near the rare plant populations is not recommended. Agricultural runoff containing herbicides, pesticides, and/or excessive nutrients poses an imminent threat to the rare species. Efforts to buffer runoff and minimize impacts should be implemented in susceptible areas. A management agreement with the landowner should incorporate best management practices and regular monitoring. The Floral Swale Protection Area is currently recognized as a Nontidal Wetlands of Special State Concern under the State's Nontidal Wetlands Regulations (see Appendix II). This designation requires that proposed disturbances be reviewed for the potential to adversely impact a habitat containing rare species and that such impacts be avoided or minimized. In order to ensure adequate protection for this site, it is strongly recommended that this designation remain.

Boundary Recommendations

The Floral Swale Protection Area boundary parallels the powerline right-of-way in which runs northwest southeast along Melville Road. This boundary has been established to include the forested corridor east of Melville Road, a small portion of the agricultural field, and a small ditch that traverses the powerline right-of-way.

Site Description

The Floral Swale Protection Area contains very little natural habitat, as most of the powerline right-of-way has been converted to agricultural fields. The powerline right-of-way contains two transmission lines in which run southeast to northwest. Located between the transmission lines and Melville Road is a narrow forested corridor of Sweet gum *(Liquidambar styraciflua)*, Sweet pepperbush *(Clethra alnifolia)*, Common greenbrier *(Smilax rotundifolia)*, and a variety of oaks *(Quercus* spp.*)*. The saturated, sandy soils along the edge of this corridor were found to support the globally rare, state endangered Creeping St. John's-wort and the two watch list species, Clustered bluets and Engelmann's spikerush. A small ditch dissects the agricultural fields and traverses the powerline right-of-way. The sloping edges of the ditch supports species such as Rough-stemmed goldenrod *(Solidago rugosa)*, Rough boneset *(Eupatorium pilosum)*, Lance-leaved violet *(Viola lanceolata)*, Arrow-leaved tearthumb *(Polygonum sagittatum)*, Steeplebush *(Spirea tomentosa)*, and the globally rare, state threatened Awned mountain-mint.

MARSHYHOPE CREEK NORTH

Federalsburg, Hickman, and Seaford West, MD USGS Quads

Ecological Significance

This complex ecological system supports many diverse habitats and natural communities. These include a mature floodplain forest of exceptional quality, xeric pine oak uplands, high quality aquatic habitat, remnant oak savannah, seepage/discharge slopes, high quality mixed-deciduous upland forest, and artificial ponds displaying early signs of bog mat formation. These habitats support at least one state endangered, two highly state rare, one state rare, and five watch list plant species.

The mature, high quality floodplain forest along Marshyhope Creek dominates this protection area and continues up Houston Branch for approximately half a mile. A distinct floodplain terrace has developed along the creek. Due to the minimal topographical relief on the Eastern Shore the flooding dynamics that create terraces are very uncommon. However, the relief along the upper portion of Marshyhope Creek is more pronounced and thus conducive to terrace development. The terrace is composed of rich alluvial soil that in turn supports a lush floodplain forest community dominated almost exclusively by native plant species. Although terrace development also occurs along Houston Branch, it is less pronounced than along Marshyhope Creek. Many floodplain terrace communities in other parts of Maryland are seriously threatened by invasion of non-native, weedy species. In contrast, this floodplain is nearly weed free. Following the snakelike course of the creek for several miles from Federalsburg to Delaware this floodplain forest is among the best examples of this community type remaining on the Delmarva Peninsula. Preliminary analysis indicates the dominant vegetation here is different from other floodplain forests in the state - suggesting this may be a unique natural community. This floodplain forest community was found to support the highly state rare Rough hedge-nettle *(Stachys aspera)* and three rare or uncommon sedges. Prior to this survey, Rough hedge-nettle was known from only one other location in Maryland. Several stations for the watch list species, Cat-tail sedge *(Carex typhina)* and Louisiana sedge *(Carex louisianica)* were observed along the floodplain from Noble Road to Houston Branch. Cat-tail Sedge is found over much of eastern North America. Maryland is near the center of the species range but there are fewer than seven known locations in the state. A portion of the floodplain near the junction of Houston Branch and the Marshyhope Creek was found to harbor the state rare Lined sedge *(Carex striatula)*, a species known from only seven other locations throughout Maryland.

Pockets of high quality, oak-dominated forest are scattered on the uplands along both Marshyhope Creek and Houston Branch. Older portions of these forest fragments display scattered large oaks with wide-spreading canopies and first limbs high above ground level. There is abundant coarse woody debris on the forest floor and a sparse but well-developed understory. Scattered pit and mound occurrences, standing dead snags, canopy gaps and advanced age and high species diversity indicate the community is maturing. A small population of the watch list species Slender Dayflower (*Commelina erecta*) occurs in a "savannah-like," oak-dominated habitat portion of the uplands.

Several abandoned sandpits near the creek are developing bog-type habitat supporting open-canopy, low nutrient, herb dominated plant communities. Orchids, sedges and insectivorous plant species now dominate scattered small areas. Although artificial in origin, these ponds provide important low nutrient bog and aquatic habitat for rare plant species. This kind of habitat has become very scarce on the Coastal Plain because of human related causes. This unusual assemblage of plants was found to include species such as the state endangered Fibrous bladderwort *(Utricularia fibrosa)*, a floating, "carnivorous" plant known from only five other Coastal Plain stations in Maryland. Adding to the area's diversity are occurrences of the watch list species Rose pogonia *(Pogonia ophioglossoides)* and the carnivorous Round-leaved sundew *(Drosera rotundifolia)*. Both species are restricted to this type of habitat and are an incredible sight when in bloom.

The beautiful state endangered Purple Passionflower (*Passiflora incarnata*) grow high and dry atop some of the gravel scree deposits remaining from mining operations. Purple passionflower often prefers disturbed areas that are sunny, hot and well drained. In Maryland, it is known only from two other locations on the Delmarva Peninsula. This population and several in nearby Delaware represent the northernmost extension of the species range. There are doubts whether this is a "natural" occurrence or an escape from a local abandoned homestead.

This protection area includes a large block of contiguous forested floodplain along Marshyhope Creek from Federalsburg to the Delaware State Line that provides excellent habitat for forest interior dwelling species. Marshyhope Creek thus forms an important wildlife corridor providing access for the free flow of both plants and animals within their natural habitat. The creek and ponds also provide breeding, nesting, and feeding habitat for resident waterbirds, migratory waterfowl and songbirds. Some of the "riffle" areas of the creek support native freshwater mussels, an indication that the water quality here is high. It also supports suitable habitat for such area-sensitive mammals as otter and mink, and reptiles and amphibians.

Rare and Uncommon Species Table

Scientific Name	Common Name	Status
Carex louisianica	Louisiana sedge	Watch list
Carex striatula	Lined sedge	State rare
Carex typhina	Cat-tail sedge	Watch list
Commelina erecta	Slender dayflower	Watch list
Drosera rotundifolia	Round-leaved sundew	Watch list
Passiflora incarnata	Purple passionflower	Highly State rare
Pogonia ophioglossoides	Rose pogonia	Watch list
Stachys aspera	Rough hedge-nettle	Highly State rare
Utricularia fibrosa	Fibrous bladderwort	Endangered

Threats and Management

Major threats to this site include potential logging operations, invasion by non-native, and weedy plant species into the floodplain from adjacent fields, alterations in the flooding regime of Marshyhope Creek or adverse changes in water quality or wetland hydrology. Any one of the above threats could degrade the floodplain community, reduce its significance as a high quality natural area and destroy its ability to support rare species.

Logging would disturb the soil, alter forest structure and change the hydrology of the site. These conditions in turn could promote the incursion of weedy plant species into the area. It would physically destroy plants including the rare species, and increase habitat fragmentation, thereby reducing the community's suitability for forest interior dwelling and area-sensitive species. Water quality could be compromised by the large quantity of sediments introduced through logging operations.

Due to the extensive area of disturbed soil already present in the vicinity alien plant species dominate large areas of nearby uplands. Adjacent fields are dominated by non-native, weedy plant species that represent considerable threat to the ecological integrity of the high quality floodplain community. Soil and/or canopy disturbances are known to facilitate the incursion of non-native weeds into native habitats. The more aggressive alien weeds often outcompete native species and may supplant them as dominants, thereby altering and degrading the natural communities. This is a particularly significant issue along this section of the creek because of the relative paucity of alien species presently occurring within the community. Allowing adjacent fields to revert to forest would create a buffer against alien weed invasion. All unnatural disturbances to the soil or canopy should be avoided.

The high quality floodplain and swamp forest communities are dependent upon the flooding regime of the Marshyhope Creek watershed including Houston Branch and other major tributaries, as well as the local groundwater hydrology. If that regimen is altered, the floodplain community will also undergo change. Altering the upstream watershed topography could adversely impact the flooding dynamics of Marshyhope Creek. Deforestation, road construction, ditching and channelization upstream affect the downstream flooding regime. Cooperation with Delaware to protect the upstream

watershed of Marshyhope Creek is important to the long-term protection of Maryland's rare species habitats in the Marshyhope floodplain. The local hydrology along the creek's course through Idylwild W.M.A. should be secured by assuring adjacent areas remain forested and undisturbed.

Construction of any kind, including recreational facilities, would promote disturbances that could adversely impact the high quality natural communities and rare plant species. Large numbers of visitors would trample and dislodge vegetation, including the rare plant species. Water activities on the ponds could cause changes in water level, introduce pollutants and sediments, cause excessive erosion on pond banks, and create waves and wakes that would disturb aquatic and emergent vegetation.

Recreational boating on the creek has been suggested. However, passage would be obstructed by numerous low hanging limbs, fallen trees and submerged logs. Efforts to remove these obstacles would significantly reduce the quality of the stream's aquatic habitat by removing resting, feeding and cover habitat for aquatic organisms. This is a very old forest, and fallen trees are part of the system. Removal would not only alter the system, it would be a recurring disturbance necessary to maintain the boat passage.

It is highly recommended that the nontidal wetlands bordering the sandpits be recognized as a Nontidal Wetlands of Special State Concern under the State's Nontidal Wetlands Regulations (see Appendix II). This designation requires that proposed disturbances be reviewed for the potential to adversely impact a habitat containing rare species and that such impacts be avoided or minimized. In order to ensure adequate protection for this site, it is strongly recommended that this designation remain.

Boundary Recommendations

Protection boundaries have been designed to include all rare species populations and habitat, the high quality upland forest community, the floodplain terrace community and adequate buffer. West and northwest boundaries are limited by the presence of improved roads and cultivated fields. Buffer in this quadrant is therefore limited and inadequate for long-term protection of the floodplain community. Options for correcting this shortcoming should be taken under immediate consideration. In some areas, the boundaries have been extended to include adjacent unused fields with the intention of allowing these areas to revert to forest to serve as buffer for the high quality communities along Marshyhope Creek. Extended buffer is important in maintaining water quality, reducing edge effect, and isolating the wetland as far as possible from alien weed sources.

Site Description

The approximate 1,320 acres of this protection area consist of both high quality upland and wetland communities. An exceptional floodplain forest community occurs along Marshyhope Creek between Federalsburg and the Delaware State Line. The mixed deciduous forest is old and shows few signs of past logging. The subcanopy and shrub layers are sparse, lending a park like appearance to the understory. Scouring from frequent and intense flooding are probably the cause of this sparse understory as well as the reason

for the unusual development of a coastal floodplain terrace. Forest regeneration appears to be in a state of stasis, as evidenced by a lack of tree seedlings and saplings. This is probably the natural result of frequent flooding. Many signs of forest maturation are evident including the following: many large trees with wide-spreading canopies; first tree limbs high above the ground; logs in various stages of decomposition; other coarse woody debris including occasional "nurse" logs; scattered canopy openings; lianas hanging from the overstory; scattered pit and mound occurrences; numerous standing dead "snags"; and a well developed and diverse herb layer. Age and species diversity of the woody forest component and development of a shrub layer were less pronounced. The forest is dominated by a Red maple *(Acer rubrum)*/Ash *(Fraxinus* sp.*)* association with a codominance in some areas with Black gum *(Nyssa sylvatica)*, Sweet gum *(Liquidambar styraciflua)* and Black birch *(Betula nigra)*. Scattered pools, pockets of muck, occasional small seeps and old oxbows occur on the terrace. Surveys for spring ephemerals and reptiles/amphibians should be a priority. There is evidence of active beaver, muskrat, otter and numerous birds. Many larger trees on the terrace display wide spreading bases (buttressing), evidence of the frequent flooding which scours the area. The soils of the terrace are largely alluvial sand with a high organic content. For the Coastal Plain, this entire floodplain terrace community is uncommon, and perhaps unique in appearance and plant assemblage. In appearance, it is more akin to a Piedmont or Upper Coastal Plain stream system. The high quality and unique character of the natural communities qualifies this site as one of the more important areas surveyed along the Nanticoke River system.

A young, but good quality upland of pine *(Pinus* spp.*)* and oak *(Quercus* spp.*)* forest occurs within the boundaries of this site. There is some evidence of logging within the past thirty years although scattered older, larger trees remain. The understory is generally sparse, and nearly absent in some places. Small areas are dominated by low heaths *(Vaccinium* spp.*)* or Reindeer Moss *(Claydonia* sp.*)* but most of the ground cover is bare leaf litter with only occasional flowering herbs. Shortleaf Pine *(Pinus echinata)* and Southern Red Oak *(Quercus falcata)* dominate most of the sandy ridge above the wetlands.

Houston Branch is a small stream with rather abrupt, steep-sloped uplands on either side. The degree of topographical relief is unusual for the Coastal Plain. The entire area is vegetated by young to maturing, second growth, and mixed-deciduous or pine-dominated forest. Upstream wetlands consist largely of the stream proper, a few small seepage areas and adjacent pockets of muck. Downstream near the juncture with Marshyhope Creek the local topography becomes gentler. The wetlands are more extensive with large areas of mucky soils, sphagnous pockets and stagnant pools. Much of the swamp and floodplain forest display signs of advancing maturation and represent an extension of the high quality community occurring along the Marshyhope.

The forested uplands along Houston Branch are sandy, sterile, acidic and very dry. A large percentage of the upland forest was recently logged. Some mats of reindeer moss occur, especially in areas of fewer disturbances. The overstory is somewhat sparse with a much denser understory. There are few standing dead "snags" and little coarse woody debris. Heaths dominate much of the forest floor.

The area around the abandoned mining operations is largely composed of highly disturbed habitats in the process of reverting to conditions that are more natural. There are many sandpits remaining from mining excavations. Some remain relatively dry during the growing season (pits), but others retain water throughout the year (ponds). A few ponds exhibit signs of early bog mat formation and some support rare plant species, three of which are associated exclusively with the artificial conditions provided by these ponds. All of the ponds provide aquatic and emergent habitat for many species of plants and animals. Those sandpits that nearly dry-up by midsummer provide saturated sandy conditions favorable for bog-like formation. Both situations provide conditions that simulate naturally occurring habitats that have become scarce due to human causes.

The sand/gravel scree deposits between excavations are very dry and nutrient poor, simulating conditions that prevail in xeric pine oak savannahs. Naturally occurring savannah conditions are largely fire dependent and were probably more prevalent before fire suppression became common practice. Without fire these semi-open, scrub conditions eventually revert to pine/oak dominated or mixed deciduous forest. There are open-sand and scrub type communities on the sterile uplands with sparse or dwarf vegetation. A viable population of the Purple Passionflower occurs in this habitat but may not persist if the community reverts to forest. Sapling pine woods dominate much of the remaining disturbed area around the ponds but an older, higher quality forest community occurs along the creek.

MILL CREEK WOODS

Hobbs, MD USGS Quad

Ecological Significance

Amidst a forested corridor oaks and Beech *(Fagus grandifolia)* is a dry ridge that parallels the north and south sides of Mill Creek. The steep, northwest-facing slopes of the Mill Creek Woods Protection Area were found to support an occurrence of the state threatened Single-headed pussytoes *(Antennaria solitaria)*. Currently, there are sixteen known extant occurrences of this species in Maryland, two of which are in Caroline County.

A small stand of Eastern hemlock *(Tsuga canadensis)* along Mill Creek is an unusual sight for this tidal freshwater system. Typically, Eastern hemlock is a northern and mountain species in which reaches its southernmost distribution on the Delmarva Peninsula. Eastern hemlock groves are a rare occurrence on the Coastal Plain of Maryland.

Rare and Uncommon Species Table

Scientific Name	Common Name	Status
Antennaria solitaria	Single-headed pussytoes	Threatened

Threats and Management

The greatest threat to the Mill Creek Woods Protection Area is development of the surrounding uplands. Continued development to the north and south of the protection area could jeopardize the ecological integrity of Mill Creek. Clearing the uplands for development or timber would increase erosion of the steep slopes along Mill Creek. Subsequently, sediment derived from erosion and runoff would place additional stress on this small tributary and the rare species' habitat. In the future, any plans for development should be carefully reviewed for potential impacts to Mill Creek and the rare species' habitat.

In addition, several prolific non-native species such as Japanese honeysuckle *(Lonicera japonica)* and Multiflora rose *(Rosa multiflora)* have established along the forest edge and in canopy gaps created by past logging activities. These highly invasive plants have the potential to displace the native plant community, as well as the rare species. Management of these non-native species around the rare plant occurrences is critical in sustaining the health of these populations. Eradication efforts should include mechanical removal of the non-native plant species.

The Mill Creek Woods Protection Area is currently recognized as a Nontidal Wetlands of Special State Concern under the State's Nontidal Wetlands Regulations (see Appendix II). This designation requires that proposed disturbances be reviewed for the potential to adversely impact a habitat containing rare species and that such impacts be avoided or minimized. In order to ensure adequate protection for this site, it is strongly recommended that this designation remain. Additionally, the Mill Creek Woods Protection Area occurs entirely within the Chesapeake Bay Critical Area and is acknowledged as a Habitat Protection Area-Listed Species Site in the Critical Area Plan.

Boundary Recommendations

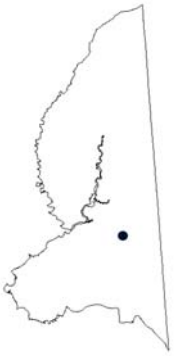
The Mill Creek Woods Protection Area boundary extends for approximately 700 meters west from Route 16 to the junction of Mill Creek and Gravelly Branch. The boundary has been designated to include the northwest-facing slopes and an adjacent upland buffer.

Site Description

The Mill Creek Protection Area consists of a steep north-facing slope occupying the south bank of Mill Creek. Fed by Williston Lake, Mill Creek meanders approximately ¾ mile to the Choptank River. Like many small creeks, Mill Creek was historically part of a gristmill operation in which resulted in the formation of Williston Lake. The dry, forested slopes lining Mill Creek are best characterized by a mixture of Beech, White oak *(Quercus alba)*, Red oak *(Q. rubra)*, Chestnut oak *(Q. prinus)*, Virginia pine *(Pinus virginiana)*, and small stands of Eastern hemlock *(Tsuga canadensis)*. Logging has occurred at the southern edge of the corridor eliminating a functional forested buffer. This has resulted in several prolific invasive plant species such as Japanese honeysuckle and Multiflora rose to thrive in the canopy gaps and along the corridor edge. The understory consists of Sassafras *(Sassafras albidum)*, Hercule's club *(Aralia spinosa)*, Mountain laurel *(Kalmia latifolia)*, and American holly *(Ilex opaca)*. Much of the ground layer consists of bare sandy soil and small patches of Black-edge sedge *(Carex nigromarginata)*, Shaved sedge *(Carex tonsa)*, and Beech-drops *(Epifagus virginiana)*. Species such as Indian Cucumber-root *(Medeola virginiana)*, Christmas fern *(Polystichum acrostichoides)*, and the state threatened Single-headed pussytoes *(Antennaria solitaria)* grow in the lower to mid-slope zone.

OPOSSUM HILL POWERLINE

Hobbs, MD USGS Quad



Ecological Significance

Opossum Hill Powerline Protection Area contains a bog-like wetland that harbors four rare plant species. Coastal Plain bogs are nontidal wetlands that support unusual botanical communities adapted to acidic, saturated soils. The bogs are usually dominated by shrubs or herbaceous species and lack trees. Many nontidal wetlands on the Eastern Shore, including bogs, have been lost due to ditching and draining for agriculture and for residential and commercial development. Powerline rights-of-way provide significant habitats for several threatened and endangered plant species. The management of woody vegetation in the rights-of-way has created habitats that are similar, although not identical, to herbaceous wetland openings created historically by fire and beaver. Natural forest openings have been nearly eliminated by modern fire suppression practices, and beaver populations on the Eastern Shore have declined drastically.

This unique site was found to support stations of the state endangered Pink sundew *(Drosera capillaris)*, the state endangered Slender nutrush *(Scleria minor)*, the globally rare, state threatened Awned mountain-mint *(Pycnanthemum setosum)*, and the state rare Tiny-headed beakrush *(Rhynchospora microcephala)*. This is the only known occurrence of Pink sundew in Caroline County and just one of four extant occurrences known to Maryland. In addition, the state threatened Awned mountain-mint and Tiny-headed beakrush are known from fewer than ten locations throughout the state. A newly discovered occurrence of Slender nutrush represents the first reported occurrence for this species in Caroline County.

Rare and Uncommon Species Table

Scientific Name	Common Name	Status
Drosera capillaris	Pink sundew	Endangered
Pycnanthemum setosum	Awned mountain-mint	Globally rare, Threatened
Rhynchospora microcephala	Tiny-headed beakrush	State rare
Scleria minor	Slender nutrush	Endangered

Threats and Management

The primary threats to the Opossum Hill Powerline Protection Area are woody plant succession and encroachment of non-native invasive plant species. A dense monotypic stand of the highly invasive Common reed *(Phragmites australis)* grows along the tributary that dissects the powerline right-of-way and abuts the boggy openings. Further advancement of Common reed could displace the native vegetation and therefore is a potential threat to the rare species populations. Measures should be taken immediately to control the spread of this perennial grass. Techniques such as the selective application of a glyphosphate herbicide are the most practical method of controlling Common reed. It is recommended that Chemical treatment occur after the fruiting period of the rare species to ensure species survival. Other mechanical methods of removal may include mowing and burning.

Moderate to advanced woody sapling succession is also a threat to this unique plant community. In order to suppress woody plant succession, mowing is strongly recommended in the late fall or early winter, so as not to inhibit the flowering and fruiting periods of the rare herbaceous plants. Not recommended is the use of heavy machinery that would compact the soil, rut the surface, and alter drainage patterns in the wetland. Additionally, clearing the adjacent forest or ditching the powerline or adjacent forest would also threaten the rare species habitat by altering the hydrologic regime in the wetland. Vegetation management is a critical component of maintaining the diversity in these highly sensitive artificial openings. A management agreement with the local landowners and the utility company is needed to ensure adequate protection for this site.

Opossum Hill Powerline is currently recognized as a Nontidal Wetlands of Special State Concern under the State's Nontidal Wetlands Regulations (see Appendix II). This designation requires that proposed disturbances be reviewed for the potential to adversely impact a habitat containing rare species and that such impacts be avoided or minimized. In order to ensure adequate protection for this site, it is strongly recommended that this designation remain.

Boundary Recommendations

The protection area encompasses the rare species habitat in the powerline right-of-way, and a forested buffer on each side. The upstream buffer incorporates the headwaters of the forested creek in order to ensure the maintenance of high water quality in the open bog.

Site Description

This 75-acre protection area encompasses a wetland in a powerline right-of-way and the forested stream that flows into the wetland. The forest surrounding the stream is dominated by wetland trees such as Red maple *(Acer rubrum)*, Sweet gum *(Liquidambar styraciflua)*, Red oak *(Quercus rubra)*, American holly *(Ilex opaca)*, Highbush blueberry *(Vaccinium corymbosum)*, Sweet pepperbush *(Clethra alnifolia)*, Swamp azalea

(Rhododendron viscosum), and Sweet bay *(Magnolia virginiana)*. Management practices within the 250 feet wide powerline right-of-way have reduced the height of woody vegetation to under approximately six feet. Vegetation dominating the slightly drier portions of the powerline contain species such as Bracken fern *(Pteridium aquilinum)*, Rice cut-grass *(Leersia oryzoides)*, Common greenbrier *(Smilax rotundifolia)*, Dodder *(Cuscuta* sp.*)*, and a variety of goldenrods *(Solidago* spp.*)*, milkweeds *(Asclepias* spp.*)*, and mountain-mints *(Pycnanthemum* spp.*)*, which include the state threatened Awned mountain-mint. The ground is quite hummocky, and the lowest, wettest areas support only Sphagnum moss *(Sphagnum* sp.*)*, Spatulate-leaved sundew *(Drosera intermedia)*, the state endangered Pink sundew, and a variety of grasses and sedges. Among the sedges represented in this assortment are Slender beakrush *(Rhynchospora gracilenta)*, the state rare Tiny-headed beakrush, and the state endangered Slender nutrush.

The main branch of the creek flows northwest through the right-of-way and is joined by a smaller branch in which enters from the south. The stream margin consists of species such as Broad-leaved Cat-tail *(Typha latifolia)*, Jewelweed *(Impatiens capensis)*, Seedbox *(Ludwigia alternifolia)*, Lizard's-tail *(Saururus cernuus)*, Common rush *(Juncus effusus)*, and a variety of sedges and grasses. Weedy species such as Japanese honeysuckle *(Lonicera japonica)*, Common reed *(Phragmites australis)*, and Virginia creeper *(Parthenocissus quinquefolia)* are also present in great numbers.

SKELETON CREEK

Preston, MD USGS Quad

Ecological Significance

The meandering and scenic Skeleton Creek is a small tributary of the Choptank River located southwest of Preston. This tributary is bordered by numerous ravines and small intermittent streams dominated by mixed deciduous hardwood forests of Beech *(Fagus grandifolia)*, hickories *(Carya* spp.*)*, and oaks *(Quercus* spp.*)*. A high quality tidal freshwater marsh system occupies most of the lower portions of Skeleton Creek to its junction with the Choptank River. Lining the upper portions of Skeleton Creek are dry, steep slopes that were found to support two small colonies of the state threatened Single-headed pussytoes *(Antennaria solitaria)*. Currently, there are only sixteen extant occurrences of this species in Maryland.

Rare and Uncommon Species Table

Scientific Name	Common Name	Status
Antennaria solitaria	Single-headed pussytoes	Threatened

Threats and Management

Upland development is the primary threat to the rare species' habitat in the Skeleton Creek Marsh Protection Area. Continued development adjacent to the protection area could jeopardize the ecological integrity of Skeleton Creek. Clearing the uplands for development or timber would increase erosion of the steep slopes along Skeleton Creek. Subsequently, sediment derived from erosion and runoff would place additional stress on this small tributary. In the future, any plans for development should be carefully reviewed for potential impacts to Skeleton Creek and the rare species' habitat.

In addition, clearing the uplands for development may encourage the growth of weedy, non-native plants. These plants have the potential to displace the native vegetation including the rare species. The extremely aggressive and non-native Common reed *(Phragmites australis)* has invaded the lower portions of Skeleton Creek. To maintain the biological diversity and integrity of the Skeleton Creek Marsh Protection Area, eradication of Common reed is highly recommended. The most practical method of

controlling Common reed is by selectively applying an approved glyphosphate herbicide to the monotypic stand. Other mechanical methods may include mowing and burning.

Due to the ecological value and significance of this protection area, it is highly recommended that development activities be prohibited. Any plans for upland development should be carefully reviewed in order to assess the potential impacts to the rare species and its associated habitat. Future management objectives should incorporate rare species monitoring and additional surveys for other rare species. Portions of the Skeleton Creek Marsh Protection Area occur within the Chesapeake Bay Critical Area; therefore, it is recommended that this site be designated as a Habitat Protection Area-Locally Significant Habitat Site under the Critical Area Program. This designation would prohibit development activities and other disturbances within the defined area unless it could be proven that such activities would not adversely affect the rare species and their associated habitat.

Boundary Recommendations

The Skeleton Creek Protection Area boundary extends north and south of Skeleton Creek Road along the eastern and western slopes of Skeleton Creek. The protection area boundary has been designed to include all the rare specie's habitats and additional forested buffer.

Site Description

Maturing forests of Beech, Red oak *(Quercus rubra)*, White oak *(Q. alba)*, Black cherry *(Prunus serotina)*, Sweet gum *(Liquidambar styraciflua)*, and Tulip tree *(Liriodendron tulipifera)* dominated the upper slopes of the Skeleton Creek corridor. Within this system, is a series of steep slopes, ravines, and small intermittent streams. The understory is well developed consisting of American holly *(Ilex opaca)*, Ironwood *(Carpinus caroliniana)*, Box elder *(Acer negundo)*, and Flowering dogwood *(Cornus florida)*. The ground layer consists of Partridge berry *(Mitchella repens)*, Christmas fern *(Polystichum acrostichoides)*, Blue-stemmed goldenrod *(Solidago caesia)*, and the state threatened Single-headed pussytoes. The eastern and western ridges paralleling the southern portion of Skeleton Creek merge with a high quality tidal freshwater marsh system.

SOUTH PEALIQUOR LANDING COVE

Hobbs, MD USGS Quad

Ecological Significance

The South Pealiquor Landing Cove Protection Area is best characterized as a large tidal freshwater marsh system containing a large monotypic stand of Spatterdock *(Nuphar advena)*. A shallow and narrow zone of intertidal habitat associated with a sand or mud-gravel substrate borders this stand of Spatterdock and the shoreline. This intermittently occurring marsh supports a small colony of the globally rare, state threatened Parker's pipewort *(Eriocaulon parkeri)* and the state endangered American waterwort *(Elatine americana)*. Currently, there are nineteen extant occurrences of Parker's pipewort in Maryland.

Due to shoreline development and stabilization efforts, habitat for intertidal species is becoming uncommon in the Chesapeake Bay and its tributaries. The intertidal marshes and open water of South Pealiquor Landing Cove provide habitat for several species of wildlife such as shorebirds and migratory waterfowl. The marsh vegetation is also important in the transfer of energy through the Bay food chain by producing detrital material, which can be utilized by zooplankton and small invertebrates. By removing suspended sediments and absorbing nutrients, the marsh vegetation aids in improving water quality of the Bay. Finally, intertidal marshes are invaluable in retarding shoreline erosion by displacing wave energy caused by wind, boat wakes, and storms.

Rare and Uncommon Species Table

Scientific Name	Common Name	Status
Elatine americana	American waterwort	Endangered
Eriocaulon parkeri	Parker's pipewort	Threatened

Threats and Management

The primary threat to the intertidal habitat in the South Pealiquor Landing Cove Protection Area is shoreline construction activities such as bulk heading, installing stone revetments, and pier construction. Upland development could also be detrimental to the rare plant populations by increasing sediment and runoff. In addition, runoff from the

golf course is a potential threat to this wetland system. Runoff containing pesticides, herbicides, and/or excessive nutrients poses an imminent threat to the water quality and integrity of the rare species. Efforts to buffer runoff or minimize impacts in susceptible areas are strongly encouraged.

The South Pealiquor Landing Cove Protection Area occurs entirely within the Chesapeake Bay Critical Area and has been designated as a Habitat Protection Area-Listed Species Site under the Critical Area Program. This designation prohibits development activities and other disturbances within the defined area unless it is proven that such activities do not adversely affect the rare species or their habitats. The South Pealiquor Landing Cove Protection Area is also currently recognized as a Nontidal Wetlands of Special State Concern under the State's Nontidal Wetlands Regulations (see Appendix II). This designation requires that proposed disturbances be reviewed for the potential to adversely impact a habitat containing rare species and that such impacts be avoided or minimized. In order to ensure adequate protection for this site, it is strongly recommended that this designation remain.

Boundary Recommendations

The South Pealiquor Landing Cove Protection Area site boundaries will retain the boundary designations established within the Critical Area Plan.

Site Description

A large tidal cove adjacent to the Choptank River Bay contains fragments of intertidal marsh bordered by large stands of Spatterdock. The substrate in South Pealiquor Landing Cove varies from sand to mud-gravel and is exposed during low tide. American threesquare *(Scirpus pungens)* dominates the sparsely vegetated intertidal zone. To a lesser extent, the intertidal zone consists of small patches of American waterwort, Lilaeopsis *(Lilaeopsis chinensis)*, a spikerush *(Eleocharis* sp.*)*, and Parker's pipewort growing in the mud-gravel substrate. Other species observed growing along the cove's shoreline include Arrow arum *(Peltandra virginica)*, Jewelweed *(Impatiens capensis)*, beggar-ticks *(Bidens* spp.*)*, Rice cut-grass *(Leersia oryzoides)*, Great bulrush *(Scirpus validus)*, River bulrush *(Scirpus fluviatilis)*, Mild water pepper *(Polygonum hydropiperoides)*, and Halberd-leaved tearthumb *(Polygonum arifolium)*. Bordering the shoreline on the upland edge are trees such as Red maple *(Acer rubrum)*, Black gum *(Nyssa sylvatica)*, Sycamore *(Platanus occidentalis)* and oak *(Quercus* spp.*)*. Land-use to the east of this site is primarily residential. In addition, a golf course borders a section of the cove's shoreline.

TUCKAHOE CREEK NORTH

Ridgely, MD USGS Quad

Ecological Significance

This site is an expansive complex of nontidal wetlands, rich woods, and sandy glades along Tuckahoe Creek. At least 16 habitat types have been identified, ranging from open water wetlands to mesic forest. The predominant wetland type is riparian forest, which is the habitat for several rare plant species. A population of a state threatened species, Deciduous Holly *(Ilex decidua)*, is one of the largest eleven known populations in the State. Louisiana sedge *(Carex louisianica)*, a state endangered species, Cattail sedge *(Carex typhina)*, a watch list species, and Purple cress *(Cardamine douglassii)*, a watch list species are also scattered throughout the riparian forest and rich woods sections of the area. Along the shoreline of a man-made lake nearby Tuckahoe Creek, grows a population of Dense-flowered knotweed *(Polygonum densiflorum)*, a state endangered species. This population represents the fourth known occurrence of Dense-flowered knotweed in Maryland.

Old fields interspersed with sandy "glade-like" openings border the riparian forest. These xeric and small openings are dominated by the state endangered Rough rushgrass *(Sporobolus clandestinus)*. This population is one of only three in Maryland and suspected to be the largest. Growing in association with the Rough rushgrass is the state endangered Downy milk pea *(Galactia volubilis)*, the highly state rare Big-topped lovegrass *(Eragrostis hirsuta)*, and the watch list species, Smooth tick-trefoil *(Desmodium laevigatum)* and Velvety tick-trefoil *(Desmodium viridiflorum)*. The highly state rare Big-topped lovegrass is currently known from only six other locations in Maryland.

Rare and Uncommon Species Table

Scientific Name	Common Name	Status
Cardamine douglassii	Purple cress	Watch list
Carex louisianica	Louisiana sedge	State endangered
Carex typhina	Cat-tail sedge	Watch list
Desmodium laevigatum	Smooth tick-trefoil	Watch list
Desmodium viridiflorum	Velvety tick-trefoil	Watch list
Eragrostis hirsuta	Big-topped lovegrass	Highly State rare
Galactia volubilis	Downy milk pea	Endangered
Ilex decidua	Deciduous holly	Threatened
Polygonum densiflorum	Dense-flowered knotweed	Endangered
Sporobolus clandestinus	Rough rushgrass	Endangered

Threats and Management

Steep slopes and highly erodible soils surround a large majority of the Tuckahoe Creek floodplain. Excessive runoff of sediment, nutrients, pesticides, and fertilizers from nearby agricultural fields pose a potential threat to the rare plant populations. In this case, it is recommended that vegetated buffer strips be used adjacent to the upland forest communities to minimize impacts.

In addition, invasive and prolific plant species such as Japanese honeysuckle *(Lonicera japonica)*, Common periwinkle *(Vinca minor)*, English ivy *(Hedera helix)*, and Multiflora rose *(Rosa multiflora)* have invaded portions of the rich woods habitat. These species have the potential to displace the native vegetation thus decreasing species diversity. Efforts to eradicate such species should be mechanical or by means of selective herbicide applications to problematic areas. Woody plant succession currently threatens portions of the sandy openings in the old fields. Numerous young Virginia pine *(Pinus virginiana)* trees grow throughout this area and could potentially shade out the rare species. A management plan incorporating woody plant removal is highly recommended for this area. Small-scale experimental prescribed burns are also highly recommended for this area in order to suppress woody growth and non-native invasive plant species.

The nontidal wetlands in the Tuckahoe Creek North Protection Area are currently recognized as a Nontidal Wetlands of Special State Concern under the State's Nontidal Wetlands Regulations (see Appendix II). This designation requires that proposed disturbances be reviewed for the potential to adversely impact a habitat containing rare species and that such impacts be avoided or minimized. In order to ensure adequate protection for this site, it is strongly recommended that this designation remain. Additionally, the Tuckahoe Creek North Protection Area occurs entirely within the Chesapeake Bay Critical Area and is acknowledged as a Habitat Protection Area-Listed Species Site in the Critical Area Plan.

Boundary Recommendations

The Tuckahoe Creek North Protection Area boundary coincides with the Habitat Protection Area for the Deciduous holly, a State Threatened species and includes the other rare species populations. Pursuant to the Critical Area Criteria, the minimum 100-foot Buffer is expanded to include nontidal wetlands, adjacent steep slopes and sandy glades, and highly erodible soils *(*COMAR 27.01.09.01.C.7*)*.

Site Description

This site includes the riparian forest along a four-mile section of Tuckahoe Creek and the adjacent slopes and sandy glades bordering the floodplain. Small "feeder" tributaries that empty into Tuckahoe Creek are also included in the Tuckahoe Creek North Protection Area.

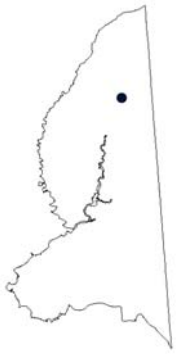
The canopy of the riparian forest along Tuckahoe Creek is dominated by Red maple *(Acer rubrum)* and Green ash *(Fraxinus pennsylvanica)*. Understory trees include Slippery elm *(Ulmus rubra)*, River birch *(Betula nigra)*, and Ironwood *(Carpinus caroliniana)*, while the shrub layer includes such species as Winterberry *(Ilex verticillata)*, Southern arrowwood *(Viburnum dentatum)*, and Black haw *(Viburnum prunifolium)*. Scattered Deciduous holly *(Ilex decidua)* also occurs within the shrub layer in large numbers. The forest floor is interspersed with flooded swales and higher, drier areas. Within the wettest areas grows Touch-me-not *(Impatiens capensis)*, Wood reed-grass *(Cinna arundinacea)*, Fowl meadow-grass *(Glyceria striata)*, Lizard's tail *(Saururus cernuus)*, and Fringed sedge *(Carex crinita)*. In less wet areas grow scattered clumps of Cattail sedge and Louisiana sedge, with Cardinal flower *(Lobelia cardinalis)*, Hop sedge *(Carex lupulina)*, Fringed loosestrife *(Lysimachia ciliata)*, and Virginia dayflower *(Commelina virginica)*. Vines cover many tree trunks including Trumpet creeper *(Campsis radicans)* and Poison ivy *(Toxicodendron radicans)*. To the west of Tuckahoe Creek, in a developed section of the park, is a man-made lake. Along the shoreline grows a large patch of Dense-flowered knotweed.

Old fields containing several small sandy glades border the ridge above the Tuckahoe Creek. These glades are dominated by the state endangered Rough rushgrass, Bluecurls *(Trichostema dichotomum)*, and Buttonweed *(Diodia teres)*. These plants are interspersed with an assortment of herbaceous species that include Butterfly pea *(Clitoria mariana)*, Bracted plaintain *(Plantago aristata)*, Oblong-fruited pinweed *(Lechea racemulosa)*, and Broom sedge *(Andropogon virginicus)*. Comprising the graminoids are species such as the highly state rare Big-topped lovegrass, Fall witch-grass *(Leptoloma cognatum)*, Tall redtop *(Triodia flava)*, and the weedy Lovegrass *(Eragrostis intermedia)*. The sandy glades also support Prickly pear *(Opuntia humifusa)*, a member of the cactus family.

The Tuckahoe Creek North Protection Area falls within Tuckahoe State Park, one of the State's most popular parks. A 60-acre lake, which lies within the site boundary, is popular for recreational activities such as fishing and canoeing. The Park also protects a National Champion Tree, the largest Over-cup oak *(Quercus lyrata)* in the United States. Seventy-one campsites are available for tent or trailer camping.

UPPER CHOPTANK RIVER

Goldsboro, MD USGS Quad



Ecological Significance

This relatively undisturbed floodplain portion of the upper Choptank River was found to support five state endangered species, one state threatened species, one state rare species, and one watch list species. A large population of the state endangered Upright burhead *(Echinodorus cordifolius)* and Prickly hornwort *(Ceratophyllum muricatum)* was found in an expansive slough along the floodplain of Choptank River. In addition, a small colony of Upright burhead was also recently located in the Choptank River floodplain just south of Red Bridges Road. This species is currently known from two other stations in Maryland, both of which are in the Piedmont. This occurrence represents the only known reported population on the Coastal Plain.

Growing in the mucky substrate along the riverbank is a small colony of state endangered Lowland loosestrife *(Lysimachia hybrida)*. This is the only reported occurrence for Lowland loosestrife in Caroline County. Scattered throughout the floodplain is the state threatened Deciduous holly *(Ilex decidua)*. Deciduous holly is known from eleven extant occurrences, three of which are in Caroline County. Portions of the floodplain south of Red Bridges Road support the state endangered Climbing dogbane *(Trachelospermum difforme)* and the state threatened Deciduous holly.

The abandoned portion of Red Bridges east of the Choptank River harbors the state endangered Downy milk pea *(Galactia volubilis)* and the state rare Reflexed cyperus *(Cyperus refractus)*. Both of these species were located in openings along Red Bridges Road on dry, sandy soils just north of Gravelly Branch.

Rare and Uncommon Species Table

Scientific Name	Common Name	Status
Ceratophyllum muricatum	Prickly hornwort	Endangered
Cyperus refractus	Reflexed cyperus	State rare
Echinodorus cordifolius	Upright burhead	Endangered
Galactia volubilis	Downy milk pea	Endangered
Ilex decidua	Deciduous holly	Threatened
Lysimachia hybrida	Lowland loosestrife	Endangered
Panax quinquefolius	Ginseng	Watch list
Trachelospermum difforme	Climbing dogbane	Endangered

Threats and Management

Major threats to this site include potential logging operations, invasion by non-native, weedy plant species into the floodplain from adjacent fields, alterations in the flooding regime of the Choptank River or adverse changes in water quality or wetland hydrology. Any one of the above threats could degrade the floodplain community, reduce its significance as a high quality natural area and destroy its ability to support rare species.

Logging would disturb the soil, alter forest structure and change the hydrology of the site. These conditions in turn could promote the incursion of weedy plant species into the area. It would physically destroy plants including the rare species, and increase habitat fragmentation, thereby reducing the community's suitability for forest interior dwelling and area-sensitive species. Water quality could be compromised by the large quantity of sediments introduced through logging operations.

Due to the extensive area of disturbed soil already present in the vicinity alien plant species dominate large areas of nearby uplands. Adjacent fields are dominated by non-native, weedy plant species that represent considerable threat to the ecological integrity of the high quality floodplain community. Soil and/or canopy disturbances are known to facilitate the incursion of non-native weeds into native habitats. The more aggressive alien weeds often outcompete native species and may supplant them as dominants, thereby altering and degrading the natural communities. This is a particularly significant issue along this section of the creek because of the relative paucity of alien species presently occurring within the community. Allowing adjacent fields to revert to forest would create a buffer against alien weed invasion. All unnatural disturbances to the soil or canopy should be avoided.

The high quality floodplain and swamp forest communities are dependent upon the flooding regime of the Choptank River watershed as well as the local groundwater hydrology. If that regimen is altered, the floodplain community will also undergo change. Altering the upstream watershed topography could adversely impact the flooding dynamics of the Choptank River. Deforestation, road construction, ditching and channelization upstream affect the downstream flooding regime. Cooperation with Delaware to protect the upstream watershed of Choptank River is important to the long-term protection of Maryland's rare species habitats in the upper Choptank River floodplain. The local hydrology along the

river's course from Goldsboro to Greensboro should be secured by assuring adjacent areas remain forested and undisturbed. Construction of any kind, including recreational facilities, would promote disturbances that could adversely impact the high quality natural communities and rare plant species.

The Upper Choptank River Protection Area occurs entirely within the Chesapeake Bay Critical Area; therefore, it is recommended that this site be designated as a Habitat Protection Area-Listed Species Site under the Critical Area Program. This designation would prohibit development activities and other disturbances within the defined area unless it could be proven that such activities would not adversely affect the rare species and their associated habitat.

Boundary Recommendations

The Upper Choptank River Protection Area boundary has been designed to include all rare species populations and subsequent habitat, the surrounding high quality floodplain forest and upland forest communities and adequate buffer. Eastern and western boundaries are limited by the presence of natural forested cover. Buffer in this quadrant is therefore limited and inadequate for long-term protection of the floodplain community. Options for correcting this shortcoming should be taken under immediate consideration. In some areas, the boundaries have been extended to include adjacent unused fields with the intention of allowing these areas to revert to forest to serve as buffer for the high quality communities along the upper portions of the Choptank River.

Site Description

The Upper Choptank River Protection Area contains a high quality floodplain forest community in which is dominated by Green ash *(Fraxinus pennsylvanica)* and Red maple *(Acer rubrum)* in the canopy. Black gum *(Nyssa sylvatica)*, Sweet gum *(Liquidambar styraciflua)* and Black birch *(Betula nigra)* occur in smaller numbers throughout the floodplain. Evidence of forest maturation exists throughout the floodplain and is denoted by several standing dead “snags”, many large trees with wide-spreading canopies, first tree limbs high above the ground, logs in various stages of decomposition, other coarse woody debris including occasional "nurse" logs, scattered canopy openings, and a well developed and diverse herb layer. The subcanopy species include Ironwood *(Carpinus caroliniana)* and young saplings of Red maple. American holly *(Ilex opaca)*, Spicebush *(Lindera benzoin)*, Deciduous holly, and dense thickets of Common greenbrier *(Smilax rotundifolia)* constitute the shrub layer. Steep slopes bordering the river are dominated by Beech *(Fagus grandifolia)*, Sycamore *(Platanus occidentalis)*, Tulip tree *(Liriodendron tulipifera)*, Willow oak *(Quercus phellos)*, White oak *(Q. alba)*, and Red oak *(Q. rubra)*. The understory consists of American holly, Common greenbrier, Mountain laurel *(Kalmia latifolia)*, White flowering dogwood *(Cornus florida)*. Pockets of rich woods habitat occupy the slopes and contain species such as Bloodroot *(Sanguinaria canadensis)*, Ginseng *(Panax quinquefolius)*, and Spring beauty *(Claytonia virginica)*.

Diversity in the herbaceous layer is high and is indicative of low disturbance. Portions of the floodplain contain species such as Mayapple *(Podophyllum peltatum)*, Skunk cabbage *(Symplocarpus foetidus)*, Yellow trout lily *(Erythronium americanum)*, Perfoliate bellwort *(Uvularia perfoliata)*, False solomon's seal *(Smilacina racemosa)*, Turtlehead *(Chelone oblique)*, and a variety of sedges *(Carex* spp*.)*. Freshwater emergent species such as Small water plantain *(Alisma subcordatum)*, Lizard's-tail *(Saururus cernuus)*, Umbellate water-pennywort *(Hydrocotyle umbellata)*, Upright burhead, and Pickerelweed *(Pontederia cordata)* grow in sloughs and along the river's edge. Other herbaceous species within the floodplain include Virginia dayflower *(Commelina virginica)*, Water purslane *(Ludwigia palustris)*, and Lowland loosestrife.

WATTS CREEK

Hobbs, MD USGS Quad

Ecological Significance

A high quality tidal freshwater marsh complex bordering Watts Creek best describes the Watts Creek Protection Area. This marsh system supports an occurrence of the state threatened Lake-bank sedge *(Carex lacustris)*, a species typically known from the Appalachian plateau. There are currently eleven known extant occurrences of Lake-bank sedge in Maryland.

Rare and Uncommon Species Table

Scientific Name	Common Name	Status
Carex lacustris	Lake-bank sedge	Threatened

Threats and Management

Intrusion of invasive, non-native species such as Common reed *(Phragmites australis)* threatens the rare plant population and should be closely monitored for population expansion. A monotypic stand of Common reed was observed growing along Watts Creek near the Lake-bank sedge population. This noxious species has the potential to overrun wetland habitats displacing the native wetland vegetation including the rare species. The most practical method of controlling Common reed is by applying an approved glyphosphate herbicide to the monotypic stand prior to frost. Other mechanical methods recommended include mowing and controlled burning.

Future management objectives for the Watts Creek Protection Area should include rare species monitoring, invasive species monitoring, and implementing a Common reed control plan. The Watts Creek Protection Area occurs entirely in the Chesapeake Bay Critical Area; therefore, it is recommended that this site be designated a Habitat Protection Area-Listed Species Site in the Critical Area Plan.

Boundary Recommendations

The Watts Creek Protection Area boundary includes the rare species' habitat and additional buffer. The boundary extends west from Route 404/313 along Watts Creek for approximately 2.5 km mile to the Choptank River. The northern and southern edge of the protection area boundary is bound by a narrow band of upland forests.

Site Description

The Watts Creek Protection Area is best characterized as a meandering tidal freshwater creek bordered by a corridor of tidal swamp forests, scrub-shrub wetlands, and emergent wetlands. The main channel of Watts Creek is skirted by a linear matrix of Spatterdock *(Nuphar advena)* and Arrow arum *(Peltandra virginica)*, which has the longest hydroperiod. This zone slightly elevates and gives way to a marsh much higher in diversity. Hummocks of Narrow-leaved cat-tail *(Typha angustifolia)*, Jewelweed *(Impatiens capensis)*, Rice cut-grass *(Leersia oryzoides)*, Swamp rose-mallow *(Hibiscus moscheutos)*, Great bulrush *(Scirpus validus)*, and Cut-leaved water-horehound *(Lycopus americanus)* dominate points of higher marsh. Other noteworthy observations include the state threatened Lake-bank sedge and an assortment of beggar-ticks *(Bidens* spp.*)*, goldenrods *(Solidago* spp.*)*, and smartweeds *(Polygonum* spp.*)*. Shrub growth is limited to the occasional Swamp rose *(Rosa palustris)* and young Red maple *(Acer rubrum)* in which occupy the tidal swamp forest/emergent wetland interface.

CAROLINE COUNTY

Protection Area Sites

1- Choptank Sandpit	**7- Opossum Hill Powerline**
2- Caroline County Delmarva Bays	**8- Skeleton Creek**
3- Caroline County Roadsides	**9- South Pealiquor Landing Cove**
4- Floral Swale	**10- Tuckahoe Creek North**
5- Marshyhope Creek North	**11- Upper Choptank River**
6- Mill Creek Woods	**12- Watts Creek**

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APPENDIX I

Definitions of State and Federal Ranking

The following are definitions of the state and global ranking of rare species utilized in this report. Originally developed and instituted by The Nature Conservancy, an international conservation organization, the global and state ranking system is used by all 50 state Natural Heritage Programs and numerous Conservation Data Centers in other countries in this hemisphere. Because they are assigned based upon standard criteria, the ranks can be used to assess the range-wide status of a species as well as the status within portions of the species' range. The primary criterion used to define these ranks are the number of known distinct occurrences with consideration given to the total number of individuals at each locality. Additional factors considered include the current level of protection, the types and degree of threats, ecological vulnerability, and population trends. Global and state ranks are used in combination to set inventory, protection, and management priorities for species both at the state and regional levels.

GLOBAL RANK

G1 Highly globally rare. Critically imperiled globally because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 Globally rare. Imperiled globally because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 Either very rare and local throughout its range or distributed locally (or even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; typically with 21 to 100 estimated occurrences.

G4 Apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery.

G5 Demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery.

GH No known extant occurrences (i.e., formerly part of the established biota, with the expectation that it may be rediscovered).

GU Possibly in peril range-wide, but its status is uncertain; more information is needed.

GX Believed to be extinct throughout its range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? The species has not yet been ranked.

_Q Species containing a "Q" in the rank indicates that the taxon is of questionable or uncertain taxonomic standing (i.e., some taxonomists regard it as a full species, while other treat it at an infraspecific level).

_T Ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species.

STATE RANK

S1 Highly State rare. Critically imperiled in Maryland because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres in the State) or because of some factor(s) making it especially vulnerable to extirpation. Species with this rank are actively tracked by the Natural Heritage Program.

S2 State rare. Imperiled in Maryland because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres in the State) or because of some factor(s) making it vulnerable to becoming extirpated. Species with this rank are actively tracked by the Natural Heritage Program.

S3 Watch List. Rare to uncommon with the number of occurrences typically in the range of 21 to 100 in Maryland. It may have fewer occurrences but with a large number of individuals in some populations, and it may be susceptible to large-scale disturbances. Species with this rank are not actively tracked by the Natural Heritage Program.

S3.1 A "Watch List" species that is actively tracked by the Natural Heritage Program because of the global significance of Maryland occurrences. For instance, a G3 S3 species is globally rare to uncommon, and although it may not be currently threatened with extirpation in Maryland, its occurrences in Maryland may be critical to the long-term security of the species. Therefore, its status in the State is being monitored.

S4 Apparently secure in Maryland with typically more than 100 occurrences in the State or may have fewer occurrences if they contain large numbers of individuals. It is apparently secure under present conditions, although it may be restricted to only a portion of the State.

S5 Demonstrably secure in Maryland under present conditions.

SA Accidental or a vagrant in Maryland.

SE Established, but not native to Maryland; it may be native elsewhere in North America.

SH Historically known from Maryland, but not verified for an extended period (usually 20 or more years), with the expectation that it may be rediscovered.

SP Potentially occurring in Maryland or likely to have occurred in Maryland (but without persuasive documentation).

SR Reported from Maryland, but without persuasive documentation that would provide a basis for either accepting or rejecting the report (e.g., no voucher specimen exists).

SRF Reported falsely (in error) from Maryland, and the error may persist in the literature.

SU Possibly rare in Maryland, but of uncertain status for reasons including lack of historical records, low search effort, cryptic nature of the species, or concerns that the species may not be native to the State. Uncertainty spans a range of 4 or 5 ranks as defined above.

SX Believed to be extirpated from Maryland with virtually no chance of rediscovery.

S? The species has not yet been ranked.

_B This species is a migrant and the rank refers only to the breeding status of the species. Such migrant may have a different rarity rank for non-breeding populations.

FEDERAL STATUS

This is the status of a species as determined by the U.S. Fish and Wildlife Service's Office of Endangered Species, in accordance with the Endangered Species Act. Definitions for the following categories have been modified from 50 CRF 17.

LE Taxa listed as endangered; in danger of extinction throughout all or a significant portion of their range.

LT Taxa listed as threatened; likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

PE Taxa proposed to be listed as endangered.

PT Taxa proposed to be listed as threatened.

C Candidate taxa for listing for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.

STATE STATUS

This is the status of a species as determined by the Maryland Department of Natural Resources, in accordance with the Nongame and Endangered Species Conservation Act. Definitions for the following categories have been taken from Code of Maryland Regulations (COMAR) 08.03.08.

E Endangered; a species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy.

I In Need of Conservation; an animal species whose population is limited or declining in the State such that it may become threatened in the foreseeable future if current trends or conditions persist.

T Threatened; a species of flora or fauna which appears likely, within the foreseeable future, to become endangered in the State.

X Endangered Extirpated; a species that was once a viable component of the flora or fauna of the State, but for which no naturally occurring populations are known to exist in the State.

***** A qualifier denoting the species is listed in a limited geographic area only.

APPENDIX II

Definitions of Wetland Designations

Non-tidal Wetlands of Special State Concern

Nontidal wetlands of special state concern (NTWSSC) are defined in the Code of Maryland Regulations (26.23.06) as wetlands that meet the following criteria:

a) Provide habitat of ecologically important buffers for the habitat of plant and animal species that are:

   i) Listed as endangered or threatened by the U.S. Fish and Wildlife Service,

   ii) Listed as endangered or threatened, or a species in need of conservation by the Maryland Department of Natural Resources or,

   iii) Considered to be a candidate for listing by the U.S. Fish and Wildlife Service, or considered to be locally unusual or rare by the Maryland Department of Natural Resources or,

b) Are unique natural areas or contain ecologically unusual natural communities.

Wetlands that are defined as nontidal wetlands of special state concern have restrictions placed on the wetlands and an expanded 100 foot buffer for the following activities: excavating, dredging, changing drainage patterns, disturbing water level or water table, filling, requires the use of "best management practices".

Geographic Areas of Particular Concern

The Federal Coastal Zone Management Act requires the designation of Geographic Areas of Particular Concern. Coastal states are required to inventory and develop management measures to protect the integrity of "areas of unique, scarce, fragile, or vulnerable natural habitats" and "areas of high natural productivity or essential habitat for living resources, including fish, wildlife, and endangered species, and the various trophic levels in the food web critical to their well being". Although this does not provide any regulatory protection mechanisms, it is a directive to the state to protect these areas under existing regulations.